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DEPARTMENT OF ENERGY FISCAL YEAR 1986 AUTHORIZATION FOR DEFENSE PROGRAMS

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HEARING

BEFORE THE

SUBCOMMITTEE ON
STRATEGIC AND THEATER NUCLEAR FORCES

OF THE

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

NINETY-NINTH CONGRESS

FIRST SESSION

ON

S. 911

TO AUTHORIZE APPROPRIATIONS FOR THE DEPARTMENT OF ENERGY FOR NATIONAL SECURITY PROGRAMS FOR FISCAL YEAR 1986 AND FISCAL YEAR 1987, AND FOR OTHER PURPOSES

MARCH 14, 1985

Printed for the use of the Committee on Armed Services

ORIGINAL

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CONTENTS

CHRONOLOGICAL LIST OF WITNESSES

	Page
Hoover, William W., Assistant Secretary for Defense Programs, Department of Energy	18
Wagner, Hon. Richard L., Jr., Chairman, Military Liaison Committee to the Department of Energy, and Assistant Secretary of Defense for Atomic Energy on Nuclear Weapons Programs	90
Batzel, Roger E., Director, Lawrence Livermore National Laboratory	116
Kerr, Donald M., Director, Los Alamos Laboratory	119
Dacey, George C., President, Sandia Laboratory	123

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DEPARTMENT OF ENERGY FISCAL YEAR 1986 AUTHORIZATION FOR DEFENSE PROGRAMS

THURSDAY, MARCH 14, 1985

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC AND
THEATER NUCLEAR FORCES,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

The subcommittee met in executive session, pursuant to notice, at 2:05 p.m., in room 222, Russell Senate Office Building, Senator John Warner (chairman) presiding.

Present: Senators Warner, Thurmond, Cohen, Hart, Bingaman, and Glenn.

Staff present: James F. McGovern, staff director and chief counsel; Robert F. Bott, John J. Hamre, George K. Johnson, Jr., professional staff members; Russell C. Miller, research assistant; and Marie F. Dickinson, staff assistant.

Also present: Henry D. Sokolski, assistant to Senator Quayle; Mark J. Albrecht, assistant to Senator Wilson; Allan Cameron, assistant to Senator Denton; Leonard Weiss, assistant to Senator Glenn; Janne E. Nolan, assistant to Senator Hart; Jeffrey B. Subko, assistant to Senator Exon; Edward McGaffigan, Jr., assistant to Senator Bingaman; Ralph M. Foushee, assistant to Senator Bingaman.

[The bill S. 911 follows:]

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II

99TH CONGRESS
1ST SESSION

S. 911

To authorize appropriations for the Department of Energy for national security programs for fiscal year 1986 and fiscal year 1987, and for other purposes.

IN THE SENATE OF THE UNITED STATES

APRIL 16 (legislative day, APRIL 15), 1985

Mr. WARNER (for himself and Mr. HART) (by request) introduced the following bill; which was read twice and referred to the Committee on Armed Services

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A BILL

To authorize appropriations for the Department of Energy for national security programs for fiscal year 1986 and fiscal year 1987, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Security Programs Authorization Act for Fiscal Years 1986 and 1987".

TITLE I—NATIONAL SECURITY PROGRAMS

OPERATING EXPENSES

SEC. 101. Funds are authorized to be appropriated to the Department of Energy for fiscal year 1986 for operating expenses incurred in carrying out national security programs (including scientific research and development in support of

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the Armed Forces, strategic and critical materials necessary for the common defense, and military applications of nuclear energy and related management and support activities) as follows:

(1) For weapons activities, $3,505,400,000.

(2) For materials production, $1,616,300,000.

(3) For defense waste and byproducts management, $405,122,000.

(4) For verification and control technology, $83,475,000.

(5) For nuclear safeguards and security, $54,325,000.

(6) For security investigations, $33,400,000.

(7) For naval reactors development, $489,000,000.

PLANT AND CAPITAL EQUIPMENT

SEC. 102. Funds are authorized to be appropriated to the Department of Energy for fiscal year 1986 for plant and capital equipment (including planning, construction, acquisition, and modification of facilities, land acquisition related thereto, and acquisition and fabrication of capital equipment not related to construction) necessary for national security programs as follows:

(1) For weapons activities:

Project 86-D-101, general plant projects, various locations, $29,900,000.

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Project 86-D-121, general plant projects, various locations, $33,700,000.

Project 86-D-103, decontamination and waste treatment facility, Lawrence Livermore National Laboratory, Livermore, California, $1,000,000.

Project 86-D-104, strategic defenses facility, Sandia National Laboratories, Albuquerque, New Mexico, $8,000,000.

Project 86-D-122, structural upgrade of existing plutonium facilities, Rocky Flats Plant, Golden, Colorado, $3,000,000.

Project 86-D-123, environmental hazards elimination, various locations, $8,700,000.

Project 86-D-124, safeguards and site security upgrading, phase II, Mound Plant, Miamisburg, Ohio, $3,000,000.

Project 86-D-125, safeguards and site security upgrade, phase II, Pantex Plant, Amarillo, Texas, $1,500,000.

Project 86-D-130, Tritium loading facility replacement, Savannah River Plant, Aiken, South Carolina, $5,000,000.

Project 85-D-102, nuclear weapons research, development, and testing facilities revital-

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ization, phase I, various locations, $81,600,000, for a total project authorization of $117,000,000.

Project 85-D-103, safeguards and security enhancements, Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore, California, $27,900,000, for a total project authorization of $32,600,000.

Project 85-D-105, combined device assembly facility, Nevada Test Site, Nevada, $45,400,000, for a total project authorization of $53,000,000.

Project 85-D-106, hardened engineering test building, Lawrence Livermore National Laboratory, Livermore, California, $1,900,000, for a total project authorization of $2,700,000.

Project 85-D-112, enriched uranium recovery improvements, Y-12 Plant, Oak Ridge, Tennessee, $15,300,000, for a total project authorization of $19,800,000.

Project 85-D-113, powerplant and steam distribution system, Pantex Plant, Amarillo, Texas, $18,500,000, for a total project authorization of $23,000,000.

Project 85-D-115, renovate plutonium building utility systems, Rocky Flats Plant,

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Golden, Colorado, $17,700,000, for a total project authorization of $20,600,000.

Project 85–D–121, air and water pollution control facilities, Y–12 Plant, Oak Ridge, Tennessee, $14,000,000, for a total project authorization of $19,000,000.

Project 85–D–123, safeguards and site security upgrade, phase I, Pantex Plant, Amarillo, Texas, $4,000,000, for a total project authorization of $5,000,000.

Project 85–D–124, safeguards and site security upgrade, Rocky Flats Plant, Golden, Colorado, $2,400,000, for a total project authorization of $3,400,000.

Project 85–D–125, tactical bomb production facilities, various locations, $11,000,000, for a total project authorization of $21,000,000.

Project 84–D–102, radiation-hardened integrated circuit laboratory, Sandia National Laboratories, Albuquerque, New Mexico, $15,500,000, for a total project authorization of $37,500,000.

Project 84–D–104, nuclear materials storage facility, Los Alamos National Laboratory, Los Alamos, New Mexico, $12,100,000, for a total project authorization of $19,300,000.

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Project 84–D–107, nuclear testing facilities revitalization, various locations, $30,540,000, for a total project authorization of $65,940,000.

Project 84–D–112, Trident II warhead production facilities, various locations, $60,700,000, for a total project authorization of $140,700,000.

Project 84–D–113, antisubmarine warfare/standoff weapon warhead production facilities, various locations, $16,000,000.

Project 84–D–115, electrical system expansion, Pantex Plant, Amarillo, Texas, $3,300,000, for a total project authorization of $14,800,000.

Project 84–D–117, inert assembly and test facility, Pantex Plant, Amarillo, Texas, $400,000, for a total project authorization of $13,600,000.

Project 84–D–118, high-explosive subassembly facility, Pantex Plant, Amarillo, Texas, $40,000,000, for a total project authorization of $47,000,000.

Project 84–D–120, explosive component test facility, Mound Plant, Miamisburg, Ohio, $2,300,000, for a total project authorization of $22,300,000.

Project 84–D–211, safeguards and site security upgrading, Y–12 Plant, Oak Ridge, Tennes-

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see, $7,500,000, for a total project authorization of $23,000,000.

Project 84-D-212, safeguards and site security upgrade, Pinellas Plant, Florida, $3,800,000, for a total project authorization of $7,500,000.

Project 83-D-199, buffer land acquisition, Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore, California, $17,000,000, for a total project authorization of $34,000,000.

Project 82-D-107, utilities and equipment restoration, replacement, and upgrade, phase III, various locations, $195,500,000, for a total project authorization of $765,900,000.

Project 82-D-111, interactive graphics systems, various locations, $6,000,000, for a total project authorization of $26,000,000.

Project 82-D-144, simulation technology laboratory, Sandia National Laboratories, Albuquerque, New Mexico, $10,300,000, for a total project authorization of $34,000,000.

Project 79-7-0, universal pilot plant, Pantex Plant, Amarillo, Texas, $4,500,000, for a total project authorization of $20,400,000.

(2) For materials production:

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Project 86-D-146, general plant projects, various locations, $34,800,000.

Project 86-D-149, productivity retention program, phase I, various locations, $27,200,000.

Project 86-D-150, in-core neutron monitoring system, N reactor, Richland, Washington, $5,460,000.

Project 86-D-151, PUREX electrical system upgrade, Richland, Washington, $3,500,000.

Project 86-D-152, reactor electrical distribution system, Savannah River, South Carolina, $4,000,000.

Project 86-D-153, additional line III furnace, Savannah River, South Carolina, $2,000,000.

Project 86-D-154, effluent treatment facility, Savannah River, South Carolina, $2,500,000.

Project 86-D-156, plantwide safeguards systems, Savannah River, South Carolina, $3,000,000.

Project 86-D-157, hydrofluorination system—FB-line, Savannah River, South Carolina, $2,200,000.

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Project 85-D-137, vault safety special nuclear material inventory system, Richland, Washington, $1,900,000, for a total project authorization of $4,400,000.

Project 85-D-139, fuel processing restoration, Idaho Fuels Processing Facility, Idaho National Engineering Laboratory, Idaho, $15,000,000, for a total project authorization of $25,000,000.

Project 85-D-140, productivity and radiological improvements, Feed Materials Production Center, Fernald, Ohio, $12,000,000, for a total project authorization of $18,000,000.

Project 85-D-145, fuel production facility, Savannah River, South Carolina, $16,000,000, for a total project authorization of $25,800,000.

Project 84-D-135, process facility modifications, Richland, Washington, $15,000,000, for a total project authorization of $32,500,000.

Project 84-D-136, enriched uranium conversion facility modifications, Y-12 Plant, Oak Ridge, Tennessee, $7,200,000, for a total project authorization of $19,600,000.

Project 83-D-148, nonradioactive hazardous waste management, Savannah River, South Caro-

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lina, $3,100,000, for a total project authorization of $22,100,000.

Project 82-D-124, restoration of production capabilities, phases II, III, IV, and V, various locations, $48,900,000, for a total project authorization of $349,534,000.

Project 82-D-201, special plutonium recovery facilities, JB-Line, Savannah River, South Carolina, $4,400,000, for a total project authorization of $83,800,000.

(3) For defense waste and byproducts management:

Project 86-D-171, general plant projects, interim waste operations and long-term waste management technology, various locations, $26,451,000.

Project 86-D-172, B plant F filter, Richland, Washington, $1,000,000.

Project 86-D-173, central waste disposal facility, Oak Ridge, Tennessee, $1,000,000.

Project 86-D-174, low-level waste processing and shipping system, Feed Materials Production Center, Fernald, Ohio, $2,500,000.

Project 86-D-175, Idaho National Engineering Laboratory security upgrade, Idaho Na-

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tional Engineering Laboratory (INEL), Idaho, $2,000,000.

Project 85-D-157, seventh calcined solids storage facility, Idaho Chemical Processing Plant, Idaho National Engineering Laboratory, Idaho, $14,500,000, for a total project authorization of $21,500,000.

Project 85-D-158, central warehouse upgrade, Richland, Washington, $5,000,000, for a total project authorization of $5,700,000.

Project 85-D-159, new waste transfer facilities, H-Area, Savannah River, South Carolina, $9,000,000, for a total project authorization of $20,000,000.

Project 85-D-160, test reactor area security system upgrade, Idaho National Engineering Laboratory (INEL), Idaho, $2,250,000, for a total project authorization of $4,250,000.

Project 81-T-105, defense waste processing facility, Savannah River, South Carolina, $205,000,000, for a total project authorization of $637,500,000.

(4) For verification and control technology:

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Project 85-D-171, space science laboratory, Los Alamos, New Mexico, $4,500,000, for a total project authorization of $5,500,000.

(5) Nuclear safeguards and security:

Project 86-D-186, nuclear safeguards technology laboratory, Los Alamos National Laboratory, Los Alamos, New Mexico, $1,000,000.

(6) For naval reactors development:

Project 86-N-101, general plant projects, various locations, $7,500,000.

Project 86-N-104, reactor modifications, advance test reactor, Idaho National Engneering Laboratory, $4,500,000.

Project 82-N-111, materials facility, Savannah River, South Carolina, $11,000,000, for a total project authorization of $176,000,000.

Project 81-T-112, modifications and additions to prototype facilities, various locations, $27,000,000, for a total project authorization of $137,000,000.

(7) For capital equipment not related to construction—

(A) for weapons activities, $277,750,000;

(B) for materials production, $123,440,000;

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(C) for defense waste and byproducts management, $38,997,000;

(D) for verification and control technology, $5,600,000;

(E) for nuclear safeguards and security, $4,600,000; and

(F) for naval reactors development, $30,000,000.

TITLE II—GENERAL PROVISIONS

REPROGRAMMING

SEC. 201. Except as otherwise provided in this Act—

(1) no amount appropriated pursuant to this Act may be used for any program in excess of 105 percent of the amount authorized for that program by this Act or $10,000,000 more than the amount authorized for that program by this Act, whichever is the lesser, and

(2) no amount appropriated pursuant to this Act may be used for any program which has not been presented to, or requested of, the Congress,

unless the Secretary of Energy (hereinafter in this title referred to as the "Secretary") transmits to the appropriate committees of Congress a full and complete statement of the action proposed to be taken with respect to the program and the facts and circumstances relied upon in support of the proposed action.

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LIMITS ON GENERAL PLANT PROJECTS

SEC. 202. (a) The Secretary may carry out any construction project under the general plant projects provisions authorized by this Act if the total estimated cost of the construction project does not exceed $1,200,000.

(b) If at any time during the construction of any general plant project authorized by this Act, the estimated cost of the project is revised because of unforeseen cost variations and the revised cost of the project exceeds $1,200,000, the Secretary shall immediately furnish a complete report to the appropriate committees of Congress explaining the reasons for the cost variation.

LIMITS ON CONSTRUCTION PROJECTS

SEC. 203. (a) Whenever the current estimated cost of a construction project which is authorized by section 102 of this Act, or which is in support of national security programs of the Department of Energy and was authorized by any previous Act, exceeds by more than 25 percent the higher of (1) the amount authorized for the project, or (2) the amount of the total estimated cost for the project as shown in the most recent budget justification data submitted to Congress, construction may not be started or additional obligations incurred in connection with the project above the total estimated cost, as the case may be, unless a period of thirty calendar days (not including any day in which either House of Congress is not in session because of adjournment of more than three

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days to a day certain) has passed after receipt by the appropriate committees of the Congress of written notice from the Secretary containing a full and complete statement of the action proposed to be taken and the facts and circumstances relied upon in support of the action.

(b) Subsection (a) shall not apply to any construction project which has a current estimated cost of less than $5,000,000.

FUND TRANSFER AUTHORITY

SEC. 204. To the extent specified in appropriation Acts, funds appropriated pursuant to this Act may be transferred to other agencies of the Government for the performance of the work for which the funds were appropriated, and funds so transferred may be merged with the appropriations of the agency to which the funds are transferred.

AUTHORITY FOR EMERGENCY CONSTRUCTION DESIGN

SEC. 205. The Secretary may perform planning and design utilizing available funds for any Department of Energy national security program construction project whenever the Secretary determines that the design must proceed expeditiously in order to meet the needs of national defense or to protect property or human life.

FUNDS AVAILABLE FOR ALL NATIONAL SECURITY PROGRAMS OF THE DEPARTMENT OF ENERGY

SEC. 206. Subject to the provisions of appropriation Acts, amounts appropriated pursuant to this Act for manage-

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ment and support activities and for general plant projects are available for use, when necessary, in connection with all national security programs of the Department of Energy.

AVAILABILITY OF FUNDS

SEC. 207. When so specified in an appropriation Act, amounts appropriated for "Operating Expenses" or for "Plant and Capital Equipment" may remain available until expended.

TITLE III—AUTHORIZATION OF APPROPRIATIONS

FOR FISCAL YEAR 1987

SEC. 301. There are authorized to be appropriated to the Department of Energy to be available not earlier than October 1, 1986, such sums as may be necessary for fiscal year 1987 for programs set forth in this Act.

OPENING STATEMENT BY SENATOR JOHN W. WARNER, CHAIRMAN

Senator WARNER. Gentlemen, good afternoon.

The chairman is advised that we are in executive session and that the room has been properly secured.

We convene in this executive session to receive testimony in support of the FY 1986 Department of Energy request for defense programs.

The subcommittee has already received testimony from Department of Defense witnesses regarding the military requirements and program details for the weapon systems, both for strategic and nonstrategic weapons, for which the Department of Energy provides the actual warheads.

In the interest of time, it is the desire of the Chair that this afternoon's hearing concentrate on the Department of Energy budget request that is pending.

The hearing will proceed with two panels this afternoon.

Our first panel includes Mr. William Hoover, the Assistant Secretary for Defense Programs, who appears before us for the first time in his new capacity, and Dr. Richard Wagner, well known to the committee for many years, who is the Assistant to the Secretary of Defense for Atomic Energy.

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We welcome you, gentlemen, and I ask that you introduce your supporting witnesses after you have given your statements.

Our second panel will consist of the Directors of the National Laboratories: Dr. George Dacey, president of Sandia; Dr. Roger Batzel, director of Lawrence Livermore; and Dr. Donald Kerr, the director of Los Alamos.

We look forward to receiving their testimony.

The subcommittee has received your statements, gentlemen, and they will be made a part of the record. The Chair invites you to submit whatever additional testimony and comments you may wish during the course of your presentations.

Mr. Secretary, we are ready.

Go ahead, Mr. Hoover.

STATEMENT OF WILLIAM W. HOOVER, ASSISTANT SECRETARY FOR DEFENSE PROGRAMS, DEPARTMENT OF ENERGY

Mr. HOOVER. It is a pleasure to appear before you again, this time in my new role as the Assistant Secretary for Defense Programs.

With your permission, what I would like to do is to summarize my statement and the statements of three of my Deputy Assistant Secretaries who are with me today—Maj. Gen. Ken Withers, Mr. Ron Cochran, and Mr. Billy Cook—and then proceed later with the statements by the three weapons laboratory directors who you have already mentioned.

So if I could proceed on that basis, sir, I would appreciate it.

Senator WARNER. Go ahead.

Mr. HOOVER. As you are aware, sir, in defense programs we have responsibility for the production, research, development, and testing of weapons, including some very exciting activities in support of the President's Strategic Defense Initiative.

We also have responsibility for nuclear material production and the handling of the waste that is generated from that, and a major responsibility for safeguarding our weapon facilities protecting the environmental activities, and we support arms control through our treaty verification and intelligence analysis.

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Department of Energy Defense Programs Complex

Weapons Development, Testing and Production and Nuclear Materials Sites

We are located at a number of facilities that stretch from coast to coast, and from the northern to southern extremes of our country. These include three national laboratories whose directors you will be hearing later, seven weapons production plants, and five nuclear material production sites. We have representatives here from some of the field locations if questions should arise regarding a further level of detail.

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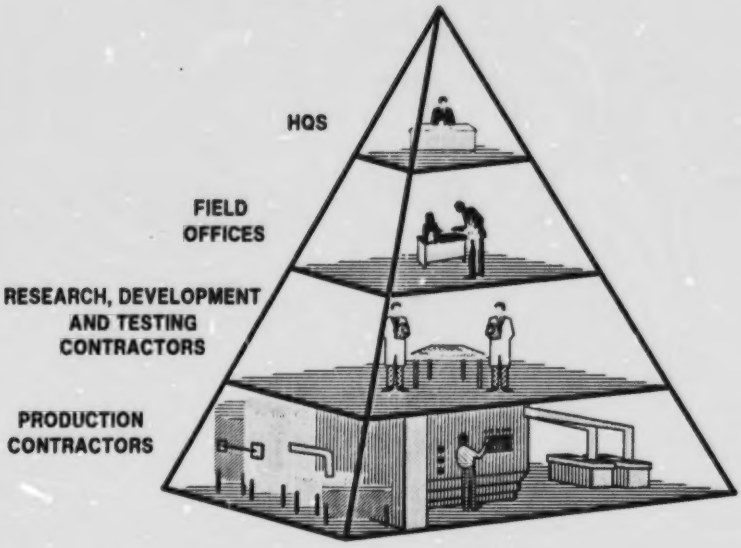

I have likened our organization to that of a major national corporation. We are somewhat unique in Government in that we actually put a product out the door and do not procure it from somebody else.

We are structured very much like a major corporation and would probably rank in the top quarter of the Fortune 500 in size and scope with corporate headquarters in Washington, represented by myself and my Deputy Assistant Secretaries. My operations office managers carry out the field functions and more or less run the day-to-day operations of the corporation. Perhaps the most pervasive part of this industry, when compared to major corporations, is the highly integrated nature of our research and development activity with our production complex. I have already indicated the extent and breadth of some of that complex to you.

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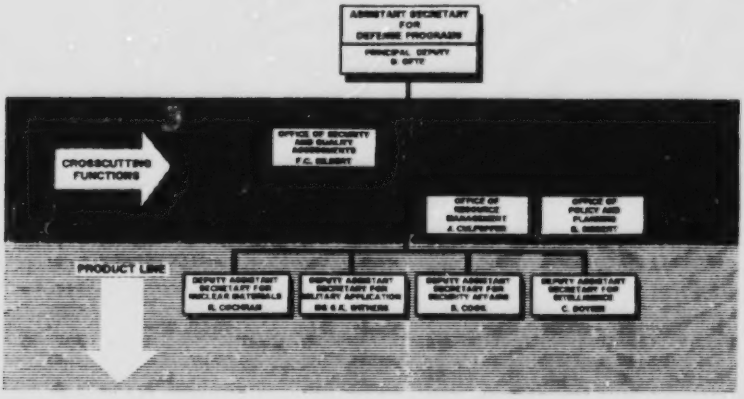
DEFENSE PROGRAMS



Since I am new in this job this year, I want to inform you of some of the changes that I have made since I have come on board.

I wanted to concentrate the energies and the activities of those who work for me along particular lines. I consider Deputy Assistant Secretaries my product division vice presidents, and I have reorganized so that they are relieved of responsibility for some of the ancillary activities that have tended to distract from what I consider to be the most important function, and that is getting product out the door.

To accomplish this, I have established offices to deal with what I call crosscutting functions, such as safeguards and security oversight, environmental, health, and safety oversight, and budget and policy matters.

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FY 1986 CONGRESSIONAL BUDGET REQUEST - DEFENSE PROGRAMS
($ IN MILLIONS)

PROGRAM COMPONENT	FY 1985 BUDGET AUTHORITY	FY 1986 AUTHORIZATION	FY 1986 AUTHORITY	% FROM 1985
RESEARCH, DEVELOPMENT AND TESTING	$1810	$1887	$1868	
PRODUCTION AND SURVEILLANCE	2324	2556	2626	
PROGRAM DIRECTION	64	99	99	
TOTAL WEAPONS ACTIVITIES	4198	4542	4593	9%
MATERIALS PRODUCTION	1751	1965	1977	13%
DEFENSE WASTE & BYPRODUCTS MANAGEMENT	730	713	715	-2%
SECURITY AFFAIRS	171	187	187	10%
UNALLOCATED ADJUSTMENTS	-16	-14	-16	
GRAND TOTAL DEFENSE PROGRAMS	$6834	$7393	$7458	9%

The total Atomic Energy Defense Activity authorization is about $8 billion, when you include the Naval Reactor Development Program. The authorization request that is before you today is for my portion of the Department of Energy's Defense Program submission and is about $7.5 billion.

That represents an increase of about 9 percent over last year. When you factor out inflation, there is a real growth of about 4 percent. That should be compared to the 6.7 percent real growth level which came out of the Congress last year after final authorizations and appropriations. So we are requesting a real growth increase this year that is lower than we came out with last year. Undoubtedly this request is a result of concerns over the deficit and we are trying to be as tight as we can in what we bring to you.

[Chart deleted.]

This chart has two messages on it: one, the 1986 banded area, shows the total number of nuclear warheads or major retrofits that we will provide to the DOD this year. That number is something like [deleted] new warheads. By the time you add in the major retrofits and other activities of that nature, we are up to close to [deleted] actual warhead activity in our various facilities.

The other message on this chart is the following. You will notice that, back in the late 1970's, we were in a very flaccid period, producing on the order of [deleted] warheads. The fact that we have been able to gear up to a very stringent production schedule is indicative, I think, of the effort, sometimes the heroic effort, that has been put forth by the defense weapons complex in achieving that goal.

For the warhead production activities, the request before you this year is $2.6 billion. That essentially funds equipment and fa-

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cilities to support warhead building, as I have just mentioned, in the seven weapons production plants.

RESEARCH AND DEVELOPMENT

For research and development—and, again, I will not go into too much detail because you will be hearing from the National Laboratory Directors—we are coming forward with a request this year of about $1.2 billion. That supports facilities, equipment, and manpower at the major national laboratories.

A very important aspect of our research activity are those activities in support of the President's Strategic Defense Initiative. We are requesting about $282 million out of the research and development budget for activities associated with the Strategic Defense Initiative.

While the President has said that our ultimate goal is a nonnuclear defense system that ultimately might allow us to change our basis for national strategic deterrence from offense to defense, there are important reasons to pursue nuclear options. One has to understand what the Soviets would do in a counterrole against our defensive systems, be it nuclear or nonnuclear offense. They will not necessarily operate under the same constraints that we would. Finally, there may be nearer term nuclear options which we can bring to bear sooner in the quest for the ultimate goal of a nonnuclear strategic defense. Later then we would be able to phase in nonnuclear systems, if and when that course becomes feasible. So we feel it is very important that the nuclear options continue to be pursued.

Senator HART. I'm sorry, Mr. Secretary. Did you give a percentage of your budget on that last slide? How did you quantify the amount of your work that is going into SDI?

Mr. HOOVER. There was $282 million out of a total research, development, and testing budget of about $1.8 billion. [Deleted.] I cannot come up with a percent for you right off the top of my head, but maybe one of my staff can.

Senator HART. Excuse me one more second.

Where do you fit into the whole SDI panoply of research? Are you the lead office or agency?

Mr. HOOVER. The focal point for the Strategic Defense Initiative is the Department of Defense's Strategic Defense Initiative Office, which is headed by Lt. Gen. Jim Abrahamson. He will submit a budget of about $3.7 billion for the Department of Defense activities.

This $282 million is in addition to the $3.7 billion. We work in a very coordinated and integrated fashion with General Abrahamson. Our efforts and his efforts are fully integrated.

Senator HART. With your permission, Mr. Chairman, let me just say that the last time I saw the Secretary, it was when he was a general, and he did a spectacular job as commander at Lowrey.

Mr. HOOVER. Thank you, sir.

Senator HART. We are very pleased to have you back with us today.

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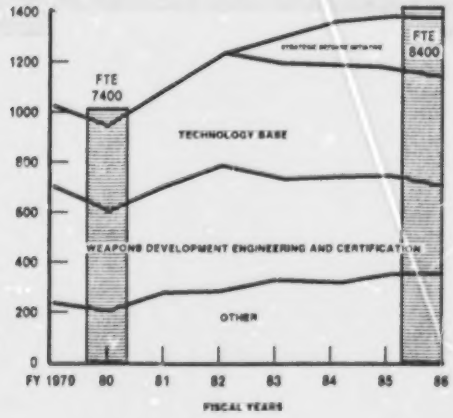
RD&T FUNDING HISTORY (IN FY 1986 DOLLARS)



Mr. HOOVER. What the $1.2 billion buys for you in terms of laboratory manpower is about 8,400 people. Again, you can see that we have been gradually increasing since a period in the late 1970's, when we were down to a lower level. We hope that this funding request will get us up to about 8,400 full-time equivalents in our national laboratories.

If you look at what the Soviets are doing, they are doing quite a bit more in terms of manpower in the research and development area.

TESTING MISSION

The ultimate test application for many of our programs is the activities that go on at the underground test site outside of Las Vegas, NV.

Our testing budget this year is about $650 million. It will support a level of tests of [deleted].

[Chart deleted.]

While this chart shows some upswing from earlier years, we have been staying relatively constant over [deleted] the last few years. I might add that current tests are more expensive because they are more complex. Every time we go down the test hole, we try to get as much data back as we can and consequently today's sophisticated tests are much more expensive than those of just a few years ago.

So, while the discreet numbers may not be changing dramatically, the amount of information we get from our test program is increasing significantly.

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NUCLEAR MATERIALS PRODUCTION ACTIVITIES

Our nuclear materials production activities is the part of the business that provides the materials to build the nuclear weapons.

As you can see on this chart, our supply has been staying just barely ahead of the demand, [deleted].

In this budget request that is before you, funding is included to operate five material production reactors.

As we look to the out-years, we do have some initiatives which we hope will leave us with a little more comfortable position on meeting the demands that we see projected.

[Chart deleted.]

Senator BINGAMAN. Mr. Chairman, may I just ask a question?

Senator WARNER. Let me say that the Chair is perfectly willing to have members ask questions. But we, of course, hope that your body of questions will be preserved until the conclusion of the direct presentation, when Senators will have a 10-minute questioning period.

But please feel free, as we go along, for a single or double question.

Senator BINGAMAN. Thank you.

Let me ask a question regarding the nuclear materials. Do you have any estimate as to whether you can meet the future demand for nuclear materials from domestic sources?

Mr. HOOVER. From domestic sources?

Senator BINGAMAN. From our domestic uranium industry, to any extent down the road.

Mr. HOOVER. Yes.

Right now, we have a substantial inventory of feed stock to allow us to enrich uranium whenever we need to. We see that that level of stock will carry us certainly into the 1990's, before there might be an indication that we need to go out and purchase additional stock. Partly that will depend upon certain demands that arise, either from weapons that we can retire or weapons that are authorized in the future.

Senator BINGAMAN. Thank you.

Mr. HOOVER. The budget request before you for the nuclear materials production complex is slightly under $2 billion for this year.

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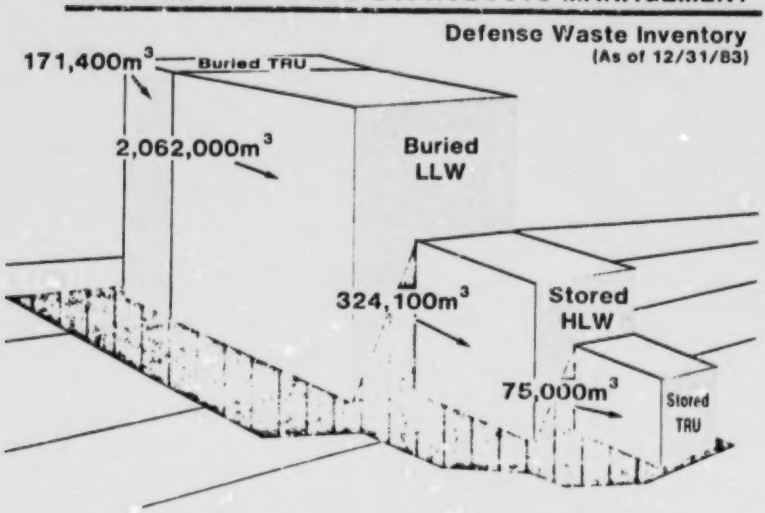
DEFENSE PROGRAMS
DEFENSE WASTE AND BYPRODUCTS MANAGEMENT



And the defense waste activities resulting from our reactor and production activities are at a level slightly less than that of last year, at about $715 million.

SECURITY AFFAIRS

The final line in the budget request is those activities under our Deputy Assistant Secretary for Security Affairs, who is responsible for the international security affairs activities that include fabricating sensors for the Department of Defense to help support arms control and treaty verification missions. Mr. Cook is also responsibile for activities related to the classification of data, that is a necessary part of our safeguards and security activities relating to the protection of nuclear weapons, nuclear materials, classified information, and the like.

SAFEGUARDS AND SECURITY

I now want to turn to the safeguards and security area in a broader sense and look at it in terms of what we are doing across the Department of Energy.

Not too many months ago, you may have seen headlines that raised some concern about the security of nuclear weapons. Certainly today we still are aware of terrorist activities that are going on, and while we are not able to identify any specific terrorist threat for any of our facilities, we certainly are mindful of the unfortunate incidents in Beirut and even the bombing of our own cap-

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itol. These incidents suggest that we cannot rest easy and assume that it cannot happen to us.

So we have devoted considerable effort to upgrading security at many of the Department's facilities.

Congress has certainly expressed its concern, and we have responded.

Across the total DOE budget, over $700 million is devoted to safeguard and security activities. That is up four-fold from just over 5 years ago.

I want to show you some pictures that will give you some appreciation for how some of that money is being spent.

[Chart deleted.]

Just quickly, the nature of the problem for us is shown.

Here you see the Oak Ridge, TN, facility which was built in the early 1940's. Then we didn't have the concern for security that we have today. Our problem now is trying to safeguard that sprawling complex which was not designed with an eye toward a terrorist threat. The physical attributes of our older facilities are one of the major problems with which we have to deal.

[Chart deleted.]

Here is Los Alamos National Laboratory. You can see it is spread over a number of mesas. It is difficult to defend in terms of a perimeter concept because you have activities that are spread all over that wide area.

These two slides help to contrast the problem that is before us.

We have added a number of guards and upgraded our guard force considerably. I think people are really one of the real keys to security. We have taken a great deal of effort to upgrade our guard forces themselves.

We have established a central training academy where we will conduct consolidated training activities for some 800 guards a year.

We have been very fortunate in being able to contract with some of the elite guard forces and some of the best security teams around the country. They are some really first-rate people.

So I feel very good that our guard force itself is seeing improvements.

[Chart deleted.]

Here is a closer view of a facility at the Los Alamos site.

This is where we do some nuclear criticality type testing.

There is nuclear material located in this area. This is what it looked like before we went about the process of upgrading. The upgrades were made on the basis of a very systematic approach stemming from actually putting in some mock-terrorist attacks on a facility such as this, to see where the vulnerability really existed.

[Chart deleted.]

This shows you some of the kinds of improvements we have made.

We have put in a number of hardened guard towers. We have literally laced the valleys with helicopter denial systems, which are wire and telephone pole apparatus designed to deny helicopters the opportunity to actually sit down at the facility.

We put machinegun mounts above on the trails, so that adversaries cannot take the high ground without us spotting them.

We have put considerable effort into just this one facility.

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I am happy to report that, although our inspection and evaluation team penetrated this facility on their first review, they were not able to penetrate it on their next visit.

This is another before and after slide of guard towers. We are replacing what literally were just corrugated metal shacks at many of our facilities with hardened guard towers. These guard towers give us the opportunity to oversee a large area. They replace some rather antiquated towers that really provided little or no protection to the guards that were manning them. These are hardened guard facilities, with a variety of communications and sensing activities.

[Chart deleted.]

Here is another indication of how we have been responding to the results of our inspections and evaluations.

This facility at the bottom contains special nuclear material. We put a mock terrorist attack against the facility, and they were able to penetrate it and get the nuclear material out.

Within 60 days, we had taken that same facility and made many improvements as you see at the top.

When the inspection and evaluation team made a followup visit, there was no way that they could penetrate that facility.

So that is the kind of effort we are putting into the problem and the kind of response we are getting once we have discovered the vulnerability.

HELICOPTERS

We have also added a number of helicopters to our total system. We have a number of very large sites, such as the site at Savannah River. We have added helicopters that give us the capability to rapidly respond with our SWAT teams and to provide a general security oversight and surveillance of our activities.

[Chart deleted.]

But it is a very dynamic situation, just like offense and defense in football, where one gets ahead and the other one figures out what to do about that. We do not rest on our laurels. We have a very aggressive inspection and evaluation system that reports directly to me. We want to go out and stress our system to see where it breaks. When it breaks, sometimes there are reports in the media. You are aware of those.

But we are going to keep on testing. I am not going to be comfortable, if everybody passes with glowing colors, that we have a system that is as good as it should be. So we stress these points, and occasionally we will find problems and vulnerabilities, and the bad guys, if you will, will win one.

But I am happy to report this year, as I could not last year, that all of our locations are now up to at least what we would say is marginally satisfactory. Last year, we had certain sites that we felt were not meeting the status that we wanted. So we have been making a great deal of progress, and we will continue to stress this excellence.

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INTELLIGENCE REPORTS ON TERRORIST THREATS

Senator HART. Are you satisfied with the intelligence you get on a potential terrorist threat?

Mr. HOOVER. We do get intelligence input [deleted] I guess I would have to say that we are satisfied. When we get surprised, ask me again.

We do get considerable support.

Senator WARNER. Is there anything that you feel is being withheld?

Mr. HOOVER. No.

Senator WARNER. So you feel you are getting full support?

Mr. HOOVER. Yes, we are getting full support.

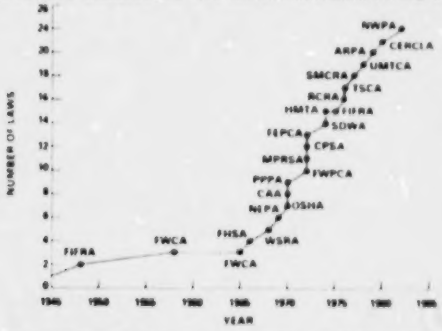
What makes me nervous is no one can identify any specific threat against us, and yet, as I say, when you see certain situations, you worry.

Senator WARNER. Well, that same issue is endemic to all other systems throughout the world.

Mr. HOOVER. The figure I gave you earlier for safeguards and security is about 9 percent of our budget. Another area that we are putting considerable effort into is protection of the environment.

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

LEGISLATION RELATED TO ENVIRONMENTAL PROTECTION



FIFRA	FEDERAL INSECTICIDES FUNGICIDE AND RODENTICIDE (1948 1972 1975)
FWCA	FISH AND WILDLIFE COORDINATION (1958 1965)
FHSA	FEDERAL HAZARDOUS SUBSTANCES (1960)
WSRA	WILD AND SCENIC RIVERS ACT (1968)
NEPA	NATIONAL ENVIRONMENTAL POLICY (1969)
PPPA	POISONOUS PACKAGING PREVENTION (1970)
OSHA	OCCUPATIONAL SAFETY AND HEALTH (1970)
CAA	CLEAN AIR (1970 1977)
FWPCA	FEDERAL WATER POLLUTION CONTROL (NOW CLEAN WATER) (1972 1977)
MPRSA	MARINE PROTECTION RESEARCH AND SANCTUARIES (1972)
CPSA	CONSUMER PRODUCT SAFETY (1972)
FEPCA	FEDERAL ENVIRONMENTAL POLLUTION CONTROL (1972)
SDWA	SAFE DRINKING WATER (1974 1977)
HMTA	HAZARDOUS MATERIALS TRANSPORTATION (1974)
RCRA	RESOURCE CONSERVATION AND RECOVERY (1976 1979)
TSCA	TOXIC SUBSTANCE CONTROL (1976)
SMCRA	SURFACE MINE CONTROL AND RECLAMATION (1977)
UMTCA	URANIUM MILL TAILINGS CONTROL (1978)
ARPA	ARCHEOLOGICAL RESOURCE PROTECTION ACT (1979)
CERCLA	COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (1980)
NWPA	NUCLEAR WASTE POLICY ACT (1982)

There are a number of environmental laws that were enacted in the 1970's, and, like most of the rest of American industry, we have some practices which at one time were acceptable but today are not. We are going to correct those practices and comply with the environmental laws that are before us.

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We are putting about 5 percent of our budget into that kind of activity right now, and we still have a lot to do in this important area.

ENVIRONMENTAL PROBLEMS

Mr. HOOVER. This is one of those subjects where you frequently will pick up the newspaper and you will see that the Department of Energy facilities had a problem. We have put a lot of effort into trying to get on top of our environmental problems.

[Chart deleted.]

I want to show you the nature of some of the problems we are dealing with.

Here is a waste site, a dump site, down, again, in the Oak Ridge area. We not only have the problem of radioactive material to deal with, but just about every other kind of toxic waste that the rest of American industry deals with. We also have that kind of problem at our facilities in terms of handling and disposal.

[Chart deleted.]

This shows you an old dump site which, when you dig it back up again and look at the barrels in which waste is stored, was stored according to the rules that existed at that time, it was perfectly all right then, but today it is not. These barrels deteriorate and we have to do something about these kinds of activities.

[Chart deleted.]

This shows a fill area out at the Lawrence Livermore Laboratory. It looks clean right now, but the problem is that in the past we buried toxic waste in the valley when we should not have. Now the runoff from the water seeps into the waste area and we have to correct the problem.

This is another example of the kind of environmental problems that are confronting us.

[Chart deleted.]

This is a view of the Oak Ridge Y-12 facility, where we have some 240 effluent discharges that we now have to control and insure that various kinds of waste are not getting into the groundwater and streams.

[Chart deleted.]

Again, this is a shot of the Oak Ridge facilities settling ponds. These settling ponds all have to be replaced. They no longer meet the requirements to contain the fluids that are in them.

[Chart deleted.]

Just to comply with the requirement to complete environmental impact statements is costly, but it is a cost burden that we all must share. This picture shows the number of documents that are required in terms of environmental impact statements for L-reactor work at Savannah River.

Environmental activities are expensive, but it is something that is important. It is very important that we insure that the American public has confidence in us and is protected from environmental problems.

Senator THURMOND. May I ask you a question?

What is the cost of those impact statements per year?

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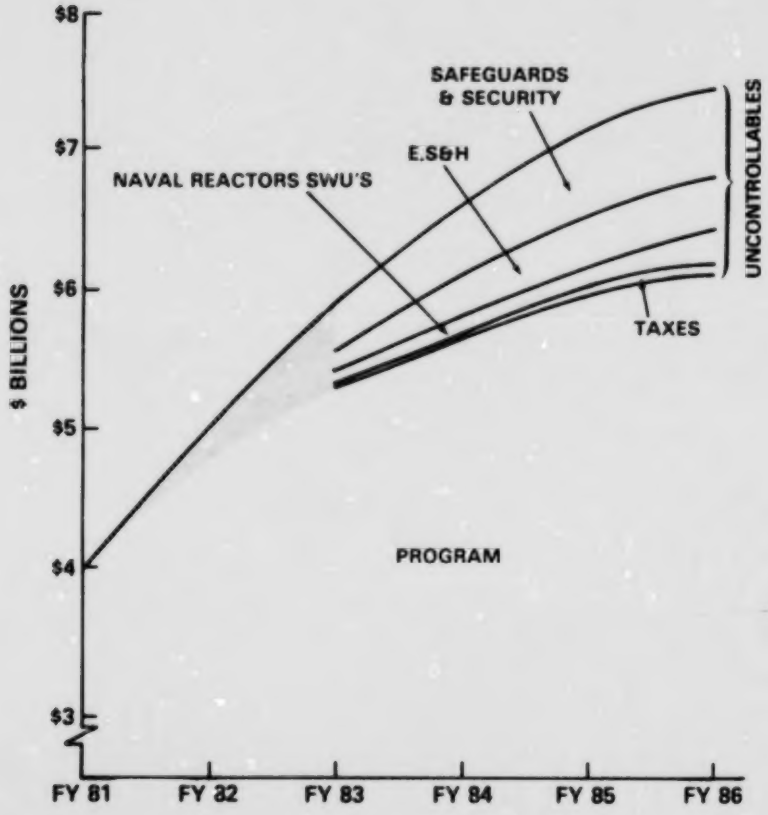
Mr. HOOVER. Well, it depends on each specific one, but I believe the L-reactor was on the order of $1 million.

Senator THURMOND. $1 million?

Mr. HOOVER. Yes; some of them run $2 or $3 million.

DEFENSE PROGRAMS FUNDING — FY 1981-1986
(FY 86 CONSTANT DOLLARS)



I said that we had a 4-percent real growth in our budget this year, but by the time you factor out support items, not directly associated with producing either nuclear warheads or material such

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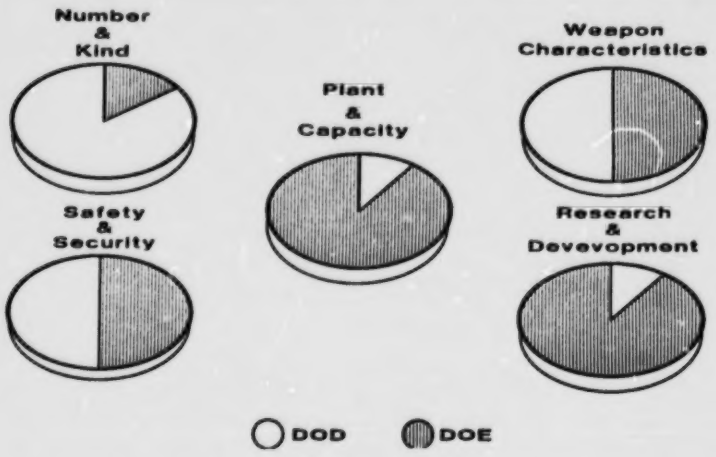
as safeguard and security activities and environmental activities as well as other various kinds of taxes on the program, our real growth this year is only at 2 percent.

RESPONSIBILITIES



This committee last year expressed some concerns that led to the formulation of what has been called a blue ribbon task force. A presidential committee to look at the requirements process and the performance activities of the Department of Energy and the Department of Defense with regard to the production of nuclear warheads. That committee has now been formed.

Basically, what I am trying to demonstrate in this particular chart is that the Department of Energy and the Department of Defense share many responsibilities in determining how much is enough with regard to the number of warheads that will be requested and the kinds of facilities that will be requested. We do work very closely together.

We have been participating with the blue ribbon committee, and we look forward to the results of what I believe is a very prestigious group.

Senator WARNER. What was your budget request? What was your input number? What presumably was the number that came out of OMB?

Mr. HOOVER. In terms of our request to OMB?

Senator WARNER. Yes.

Mr. HOOVER. We were about $500 million above $7.5 billion.

Senator WARNER. So you got a cut of a half billion?

Mr. HOOVER. Yes. That number is about right.

That was down again from the requests that were submitted to us by the field. Their submissions contained what they believed

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they needed to do the full extent of the job without having to prioritize activities.

Senator COHEN. Do you have any responsibility for reducing the number of nuclear weapons or warheads?

Just suppose you had to take some out and take them apart?

Mr. HOOVER We make recommendations on the basis of what might be optimum. In terms of our production schedule we participate with the Department of Defense in determining the particular requirements of the weapons.

Senator COHEN. Just on your first point. You delivered [deleted] new weapons and retrofitted [deleted]. What about ones that the administration determines it wants to dismantle? Do you have any responsibility for that?

Dr. WAGNER. Yes. During fiscal year 1986. [deleted] weapons will be dismantled and totally destroyed. Maybe it is [deleted] I am not sure. The stockpile will [deleted].

Senator WARNER. So, essentially, you are not the policymakers. You carry out the orders of those who establish policy?

Dr. WAGNER. Yes.

DEPARTMENT OF ENERGY—DEFENSE PROGRAMS, FY 1986 BUDGET SUMMARY HIGHLIGHTS

Deliver [deleted] new weapons and retrofit [deleted] existing weapons.
Support 9,060 FTE's for research and development, including strategic defense initiative and reduced initial fusion program.
Conduct [deleted]-shot underground nuclear test program.
Operate five production reactors and related processing facilities to meet materials requirements.
Continue waste management operations.

Mr. HOOVER. As I have already indicated, the requested level of effort in the laboratories, considering full laboratory manpower and funding will be about 9,100 for research and development and allow an [deleted] underground test program. We will be able to operate five production reactors and continue the waste management activities.

DEPARTMENT OF ENERGY—DEFENSE PROGRAMS, FY 1986 BUDGET SUMMARY HIGHLIGHTS

Initiate 24 new construction projects.
Continue 49 ongoing construction projects.
Continue restoration and revitalization—9 percent.
Correct environmental deficiencies—5 percent.
Continue safeguards and security upgrades—9 percent.

Mr. HOOVER. We will be initiating some 24 new projects, continuing 49 projects that have already been authorized and appropriated. About 9 percent of our activity will be devoted to what we call revitalizing the aging plant that was allowed to deteriorate in the period of the 1970's; about 9 percent for safeguards and security; about 5 percent for environmental activities. That, in broad terms, is what is in the budget.

We have tried to come to you with a budget request that we believe does provide the flexibility to pursue a prudent level of national security options, but also taking into account the stringent nature of our economic situation.

That basically is my report.

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[The prepared statements of Mr. Hoover, General Withers, Mr. Cochran, and Mr. Cook follow:]

PREPARED STATEMENT OF WILLIAM W. HOOVER, ASSISTANT SECRETARY FOR DEFENSE PROGRAMS, DEPARTMENT OF ENERGY

INTRODUCTION

Mr. Chairman and members of the Committee, it is my pleasure to appear before this Committee once again to testify in support of the Department of Energy's Atomic Energy Defense Activities appropriation request.

During the last 5 years when I appeared before this Committee, my responsibility had been the Department of Energy's Weapons Program. Now I come before you as the Assistant Secretary, with responsibility for all of the Department of Energy's Defense Programs. Today I would like to share with you my personal concerns and some of the challenges we face in successfully managing our varied activities, in the context of the Department's funding request that is before you. With me today are the Weapons Laboratory Directors, who will discuss some of their plans for the coming year. In addition, the programmatic Deputy Assistant Secretaries and Mr. Ray Romatowski, Manager of the Albuquerque Operations Office, are present to answer any questions you may have.

(Chart 1) The Defense Programs mission is indeed varied. We design, test, manufacture, and support all of the United States' nuclear weapons. We produce the nuclear materials, primarily plutonium and tritium, and budget for the separative work needed to produce the enriched uranium necessary to run our production reactors, to build weapons for the stockpile, and to fuel the nuclear Navy. We provide for both interim and long-term management of our radioactive and other wastes. We support the United States arms control and nonproliferation activities with treaty verification systems and hardware, export control tasks, and intelligence analysis. And, very importantly, we perform all of these functions, many of which are unique and some of which are potentially hazardous, with the highest standards of safety; with the nuclear material safeguards and security measures necessary to prevent any improper access to our nuclear weapons, facilities and sensitive materials; and with appropriate concern for protection of the environment.

Since last year's hearing we have realized a number of outstanding achievements in Defense Programs. Although the various witnesses will be covering them in detail, I would like to highlight several of the more significant ones. We have met the most demanding requirement for delivery of new weapons to the Department of Defense since 1974; demonstrated scientific progress and increased understanding in research and development on advanced weapons concepts; realized greater benefits from our continuing efforts to increase productivity and reduced costs in our weapons laboratories and production plants; set a new record for the production of nuclear materials with our reactors at Savannah River; reactivated ahead of schedule the plutonium recovery plant at Richland and exceeded production goals; and made major strides toward permanent disposal of defense waste. All of these are important contributions to the successful accomplishment of our Defense Programs mission.

(Chart 2) Shown here is a map that depicts the operating location of our various facilities—stretching from coast to coast and from the northern to southern extremes of the continental U.S.

(Chart 3) Like a national corporation, we have a large and important task. In my previous testimony, I compared the weapons complex to such an organization—to one of the "Fortune 500" in size and scope. We have a well-defined and integrated corporate-type structure with the approximately delegated authorities and responsibilities for our various activities.

(Chart 4) At the corporate level here in Washington, we have made some organizational changes in order to assure independent oversight of certain crosscutting functions and attain better management focus and integration among the various programs. I believe these changes will assist us in successfully carrying out our tasks with the continued confidence of the Congress, the public, and the Department of Defense. Further, three of my four Deputy Assistant Secretaries have been newly appointed to their current positions. All of these members of the Defense Programs team are here today and I would like to introduce them to you, starting with Mr. Donald Ofte.

If I were to continue the corporate analogy, Mr. Ofte, my Principal Deputy, would be the Executive Vice President. Before joining my office last fall, he served as Deputy Manager of our Albuquerque Operations Office. I rely heavily on him to

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manage Defense Programs when I am out of town, and otherwise to generally assist me on a broad range of assignments.

Dr. F. Charles Gilbert runs the newly established Office of Security and Quality Assessments. This office, which reports directly to me, is responsible for two very important functions: safeguards and security inspections and evaluations; and environmental, safety, health and quality assurance functions. Later, I will say more about these essential functions of this new office. The other two offices, which already existed, also have crosscutting functions and have been given additional responsibilities and staff. The Policy and Planning Office is directed by Mr. Bryan Siebert, and Resource Management by Mr. James Culpepper.

Now let me move down the chart to the organizational line of Deputy Assistant Secretaries who, in the industrial world, would be vice presidents, each heading a major product line of our firm. Mr. Ronald Cochran, whom you will remember as our former Director of the Office of Nuclear Materials Production, is the new Deputy Assistant Secretary for Nuclear Materials.

Our newly appointed Deputy Assistant Secretary for Military Application, Major General G. Kenyon Withers, has come to us from the Department of the Army, where he was Deputy Assistant Chief of Engineers.

Mr. Bill Cook is now our new Deputy Assistant Secretary for Security Affairs. He recently has retired from the Army, and most recently was responsible for the security of the U.S. nuclear weapons in NATO. Each of these members of our Defense Programs management team will testify later, describing his program plans for Fiscal Year 1986.

Last, but by no means least, is Mr. Charles Boykin, our Deputy Assistant Secretary for Intelligence, with that responsibility for the entire Department of Energy. His program and funding request will be covered by Mr. Cook in his presentation; but, of course, Mr. Boykin, who has been in his position for just more than one year, is here to answer any questions you may have.

My corporate staff, which I have just introduced, and the Operations Office Managers, my operating vice presidents, in our principal field offices, all but one of whom have been appointed to their respective positions within the last 4 years, represent the new Defense Programs management team—the changing of the guard. A team that is dedicated to excellence and solving our problems in an open and forthright manner. In keeping with this approach, I want to assure you that we will be in communication, informally and formally through the Departmental channels as appropriate, to keep you fully and currently informed and as necessary to seek your approval of such program changes as may be required in the accomplishment of our mission.

PERSONAL POLICY

(Chart 5) Before we discuss our program requirements underlying the Department's FY 1986 authorization request, I want to share with you my personal priorities, other than the fundamental priority of meeting the product goals of National security, which I consider important to this task. They flow from the basic fact that we must do our job, and do it well, but we also must be perceived as doing a good job—by the public, the Congress, the rest of the Administration, and closest to home, within the Department of Energy. Accordingly, I am devoting increased management attention to safety in all its dimensions, safeguards and security, environmental concerns, and our responsibility to be a good neighbor at all of our locations. Doing a good job in each of these areas of responsibility is of vital importance if we are to continue meeting the Nuclear Weapons Stockpile Memorandum requirements with the best nuclear weapons that can be built.

However, the public concern for environmental, health and safety matters can be treated separately without blurring the important role of and debate on the United States nuclear deterrent in our national security and general well being.

Our policy is that every reasonable precaution will be taken in the performance of work by Defense Programs organizations and at Defense Programs facilities to protect the health and safety of employees and the public; to protect the environment and prevent property damage or loss of production; and to assure that the lines of responsibility and accountability through all organization elements for environmental, safety, health and quality assurance related matters exist and are clear, direct, and consistent with security requirements.

SAFETY

(Chart 6) In doing our task, we must develop and test nuclear weapons through [deleted] underground nuclear explosions. Weapons production as well as develop-

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ment requires that we currently operate four (soon five) nuclear materials production reactors of a size and complexity comparable to commercial nuclear power plants. We must process the radioactive materials and waste generated in those reactors. We must transport and fabricate these radioactive and other more common materials into weapon components. We must avoid criticality conditions in our handling of fissile materials. We must process and fabricate high explosives. We also perform a myriad of more conventional research, development, materials processing and fabrication operations. I submit there are few, if any, other industrial enterprises in this country with a safety challenge equal to ours. Our safety record is commendable and has been achieved with diligence, dedication, and sustained effort, which we will continue.

Our lost time accident and injury rates are one-fourth that of private industrial experience, and our fatality rate is about one-third of our industrial counterparts. In our case, these fatalities are virtually all the result of conventional industrial mishaps, such as construction, electrical, and slip-fall accidents.

Successful as we have been, we cannot keep up the good work without sincere and strong management attention at all levels in our Federal and contractor organizations. We cannot compromise on safety.

The provision of safety, health, and environmental measures is a responsibility of my "Operating Vice Presidents," in the Field Offices and their associated contractors.

As in any industrial organization committed to high quality in its operation, we have sought a better balance in the assignment of accountability for quality control and assurance between those responsibile for products and those responsible for oversight. Of course, the Department of Energy's Office of the Assistant Secretary for Policy, Safety, and Environment has Department-wide oversight responsibility for safety matters, except for nuclear weapons safety. However, in order to maintain and improve on our already high safety and quality assurance standards, I have established a new office reporting directly to me to oversee the quality of our Defense Programs industrial, reactor, and nuclear weapon safety; and health and environmental programs across all of Defense Programs. This Office of Security and Quality Assessments also has responsibility for nuclear safeguards and security inspections and evaluations.

SECURITY AND NUCLEAR MATERIAL SAFEGUARDS

(Chart 7) The Congress, the Administration, and the Department are all committed to enhancing the overall security of our nuclear weapons, nuclear materials, and our critical facilities. Our Defense Programs strategy is to strive to prevent sabotage, intrusion attempts, and nuclear material diversions. While it is not possible to guarantee absolute security, so far, we have been successful in that we have yet to experience such incidents apart from a few nonviolent antinuclear weapon demonstrations. While we are not aware of any specific terrorist group which has targeted any of our facilities, we are not unmindful of world-wide terrorism and the tragedies of Beirut and the bombing of the U.S. Capitol.

I believe that to continue our success, our best approach is one of deterrence. If we are perceived as being well protected, such that anyone motivated to do us harm would understand that his chances of success were small to none, and the risks to his personal safety were very high, it is highly unlikely that he would make the attempt. However, it is not sufficient to just **appear** to be secure. We also must **be** secure in the event of some irrational adversary action. To this end our guard forces have been expanded, with vastly improved and more standard training at our new central training academy; modern equipment and other appropriate security upgrades have also been effected, and more are in progress. About nine percent of our budget is devoted to safeguards and security matters.

But, as in any protective system, you need to stress that system to assure it will perform as you expect it to. As part of that emphasis I have reorganized the Safeguards and Security Inspection and Evaluation activities and provided greater organizational independence and visibility.

(Chart 8) We have increased the staff devoted to the inspection and evaluation effort and established a schedule of vigorous nuclear material safeguards and security inspections at each major Department of Energy site at least once every 18 months. These inspections address all aspects of the protective system, ranging from documentation of procedures to the conduct of force-on-force exercises. (Chart 9) At this time last year, some of our most critical facilities had not achieved the level of security protection that we deem essential. I am pleased to report that this inspection and evaluation program and the management emphasis behind it is already

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bearing a great deal of fruit in terms major improvements in commitment and performance at all of our sites. We have made substantial progress, and we have more to do.

ENVIRONMENTAL CONCERN

Now, let me shift to the subject of protecting the environment. There is no need to remind you that this is a time of change for us all in the management of hazardous wastes. (Charts 10, 11, 12) My concern is that we protect our neighbors, preserve the air and water quality, and otherwise behave responsibily in compliance with environmental laws and regulations. And—we must work at being perceived as complying in a responsible manner. (Chart 13) However, public perceptions are not always correct regarding real risks, and the concerns of most actual importance. (Chart 14) Since changing to new means of protecting the environment to meet the more stringent requirements of the recent legislation and regulations can be very expensive, we must be sensitive to the real needs of our neighbors and work with them in understanding the appropriate priorities. We are also well aware of the limitations imposed upon us by the taxpayers, and the Congress which provides our authorization and funding. We are seeking to achieve a reasonable balance in addressing environmental needs and accomplishing our mission by discussing and resolving approaches available with government officials at all levels commensurate with the benefits and the costs of the options open to us in solving these problems.

GOOD NEIGHBOR POLICY

(Chart 15) We often find instances of bad news with regard to environmental, safety, and security problems. But there is also much good news associated with our community participation which is often ignored and not communicated. I am convinced that we must contribute to the society in general in every way we can and communicate with the public our intent to do so.

We have reemphasized the need in all that we do, to display respect and consideration for our neighbors, and to support local civic activities both at the institutional and individual levels. Through outreach efforts such as these, accomplished with propriety and good taste, we can demonstrate our contributions to the general well-being of the community, including our general economic contribution through wages and taxes and more specific spin-offs as technology transfer to the private sector.

DOE ROLE IN NATIONAL DEFENSE

(Chart 16) The Department of Energy's responsibility for research, development, and production of the United States nuclear weapons stems from the Atomic Energy Act of 1954, and has been continued under the DOE Organization Act. The law requires Presidential approval of the weapons to be built, and the annual Nuclear Weapons Stockpile Memorandum, approved by the President, is the mechanism from which we draw our authority for the specifics of our program.

The Nuclear Weapons Stockpile Memorandum is developed jointly by the Department of Defense and the Department of Energy, working through Dr. Wagner, the Assistant to the Secretary of Defense for Atomic Energy, and the Military Liaison Committee. It constitutes production and retirement approval for a 5-year period and planning guidance over the next 10 years.

(Chart 17) This chart shows the total number of weapons DOE has provided and is to provide to the DOD each year, spanning the time from 1970 out to 1995. While our total nuclear weapons stockpile is scheduled to gradually increase, the bulk of production is essentially to modernize our weapons as we retire older systems each year. It is this delivery schedule that determines our requirements. We must actually build the weapons required in any given year and at the same time prepare, through research, development, testing, preproduction engineering, and procurement, to accomplish our future build requirements. This includes, of course, not just the weapons themselves, but provision of the contained nuclear materials, management of the radioactive and other wastes, and conduct of our supporting activities.

(Chart 18) Our materials production supply and demand situation for the next 15 years is shown here. The DOE plant capacity to build the weapons and supply the materials needs over those met from retired weapons has been increased over the last 5 years to match the DOD requirements. The need to continue increasing our plant capacity will be addressed in detail later. Meanwhile, the point I wish to leave with you is that while we can proudly point to meeting a significant workload, we are stretched awfully tight.

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INVESTMENT STRATEGY

(Chart 22) The Defense Programs investment strategy is a meaningful way to describe the substance of our authorization request for FY 1986.

Production.—I have already discussed the need to manufacture the weapons and produce the nuclear materials required by the Nuclear Weapons Stockpile Memorandum, and to prepare now to meet those needs in the future. [Deleted.] I believe we have performed reasonably in meeting our production strategy.

Balanced Weapons Research and Development.—We must provide our research, development, and testing program with resources to solve near-term problems and to explore the future, not forgetting that we need the brightest people possible. We need to address a broad set of disciplines, allow intellectual freedom, and provide the incentive of challenging work in the best of facilities in order to assure continued technical superiority. Again, in terms of numbers, we have been striving to achieve a base of about 8,500 full-time equivalent laboratory employees and an underground test program of [deleted] tests per year. We have more to do here.

Restoration, Revitalization and Improved Productivity.—The renewed emphasis on maintenance and restoration of our plant facilities and the revitalization and productivity improvements efforts, all begun in just the last 5 years with your support, must be continued. We cannot rest on our laurels and ignore again the need to keep our plant and research facilities up to modern standards, even in the times of somewhat reduced production in our forecast. The materials production program is modernizing operations at Fernald and improving fuel fabrication at Savannah River. Our production reactors are operating at the highest capacity ever. Defense Waste is avoiding the construction of new waste tanks at Savannah River through careful planning and waste concentration efforts. These are just a few examples of steps we are taking to reduce the costs of our work and the results being achieved. We are making good progress in this area. However, restoration—keeping aging plants viable—is a never ending battle. Revitalizing our facilities, particularly our research and development facilities, is key to attracting the best people.

Environmental and Security Responsibility.—Whatever the disparate views about nuclear weapons and the facilities required for their production, we must assure and demonstrate to the public that our facilities are operated in a safe, secure, and environmentally acceptable way. We have made progress, but have more to do.

Support Arms Control and Verification.—We are charged with the responsibility to develop and produce the technology to monitor foreign nuclear explosions conducted underground, in the atmosphere and in space, and to monitor compliance with nuclear weapons related treaties. Further, we are called upon to provide technical and analytical support as the Department of Energy interagency role in nuclear arms control negotiations and policy formulation. We are increasing the emphasis on this program, and have more to do.

Within our investment strategy there are two issues which deserve additional attention: the Strategic Defense Initiative, and how well we do in managing our business and the costs of nuclear weapons.

While General Withers will cover the Strategic Defense Initiative in detail, I would like to emphasize some of the broader philosophy behind it. (Chart 23).

The President has stated that the fundamental reason for this effort is to relieve the world-wide civilization from the specter of the mutually assured destruction which we now face. Since this Strategic Defense approach in the hands of both sides could render all current ICBM forces ineffective and so obsolete, the world could protect national interests by a return to more conventional forces which in turn are possible to defend against.

The Department of Energy's Strategic Defense Initiative related research is carried out in the technology base portion of the weapons research, development and testing program, working toward development of nuclear directed energy weapons concepts. We are pursuing approaches that may apply in the nearer term, to serve as a hedge if nonnuclear concepts are not available when needed to better understand what options may be available to the Soviets, particularly if we operate under different restraints than they might, or in the event of a Soviet ABM breakout.

A second issue that is inherent in our investment strategy centers on how we manage our business. (Chart 24) Are we able to keep down the costs of nuclear warheads? What kind of management system do we use to ensure proper coordination between the Department of Defense and ourselves? Are there cost-effective improvements that can be made in our budgeting and management procedures? These questions and a number of others were addressed in the so-called "Starbird Study" some 5 years ago. In the ensuing period, we have made a number of changes to improve our coordination in the development and production of nuclear weapons for the

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stockpile. We have established a more rigorous discipline of productivity analyses to identify design tradeoffs to minimize costs that will be readily apparent in warhead systems entering or about to enter the stockpile. We have a system for establishing baseline cost estimates and tracking component costs against estimates to enable identification of problem areas and to effect production economies. Thus, we are now able to more clearly examine the unit costs of warheads at each stage in their design, engineering, and production, allowing cost to receive appropriate attention as an important factor in the overall optimization of each weapon system. Many of these improvements we have been able to incorporate in weapons currently in production. But the real improvements will be most apparent in those systems yet to enter production such as the warheads for the M-X Peacekeeper and the Trident II.

We believe that when you look closely at these improvements and the management systems in place, you will see that cost management continues to be a key element in the conduct of Defense Programs.

DEFENSE PROGRAMS BUDGET GROWTH, 1981–1986

Funding for the Department's Defense Programs has increased substantially over the past 5 years. A moment ago, we looked at charts showing the weapons program build schedule, our "mountain chart," and the nuclear materials supply and demand picture. These graphics certainly show that there has been program growth, necessary to support rebuilding of our nuclear arsenal. However, as the Committee considers our request, we hope it will keep in mind that all of the budget increase cannot be attributed to programmatic increases. (Chart 25) This chart shows the estimated costs associated with putting our products out the door. State taxes, safeguards and security upgrades, environmental improvements and the additional other costs to our budget, such as cost of enriched uranium needed for the nuclear Navy, have all increased.

The chart has been prepared in constant FY 1986 dollars so that the effects of inflation are removed. The other factors imposed upon us over the time covered have increased significantly since 1983, leaving $6.1 billion as the approximate cost of our real program in FY 1986.

SUMMARY HIGHLIGHTS

(Chart 26) The Defense Programs FY 1986 appropriation request is for approximately $7.5 billion, which represents an increase in Budget Authority of approximately 9 percent, or about 4 percent after adjusting for inflation. And, as we discussed above, our real program growth is about 2 percent. Our request provides:

Weapons Activities (Chart 27): Production of 8 different types of weapon systems. Research, development, and testing, with an increase primarily for research on Strategic Defense Initiative. Inertial Confinement Fusion has been included in the research, development, and testing program and will now concentrate on weapons physics applications. Its actual level will be determined by competition within funding to support weapon development. Continuation of operational support activities such as restoration, revitalization, environmental and safeguards upgrades.

Materials Production (Chart 28): Near-term production activities, including the first year of L-Reactor operation, increased Purex operations, and continued research and development on Special Isotope Separation. Funding for enriched uranium, most of which is for the nuclear Navy.

Continuation of the Waste and Byproducts Management operations and construction of the Waste Isolation Pilot Plant and the Defense Waste Processing Facility.

A Security Affairs activities increase for space systems detection activities in support of treaty verification and other related monitoring requirements, and continuation of the Safeguards and Security development effort.

This request, like any budget, is not without some risks. We have, for example, slowed somewhat our efforts to revitalize and modernize our facilities, maintained only minimal flexibility in meeting the demand for nuclear materials, and increased the competition for technology base funding by concentrating Inertial Fusion more specifically on weapons physics applications. (Chart 29) Notwithstanding these risks, I am confident we can meet our overall objective.

CONCLUSION

Let me complete my statement with the observation that nuclear weapons' greatest deterrent is in peacetime, and our fervent hope is that they will never be used. Further, if the upcoming arms talks with the Soviets are fruitful and verifiable re-

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ductions in our respective strategic nuclear forces are possible, this would be the first step to eliminating the need for any nuclear weapon.

Nonetheless, I also believe that successful negotiations with the Soviets are possible only from a position of strength. I urge the Committee's approval of our budget request. (Chart 30) It is large enough to support a strong U.S. position in the arms negotiations, yet modest enough to be responsible in light of the budget deficit concerns.

I will be pleased to answer any questions the Committee may have.

PREPARED STATEMENT OF MAJ. GEN. GEORGE K. WITHERS, JR., USA, DEPUTY ASSISTANT SECRETARY FOR MILITARY APPLICATION

It is my pleasure to appear before you today to discuss the President's request for the Department of Energy (DOE) weapons activities program. This is my first appearance as the Deputy Assistant Secretary for Military Application. I have a number of issues to discuss with you, in addition to the explanation of our budget estimates, but first I would like to present a little of the history of what we are doing, and how we got to where we are today.

OVERVIEW

Starting with makeshift laboratories and borrowed equipment at the Los Alamos National Laboratory, our predecessors conceived, built and tested the first atomic bombs—the weapons which ended World War II. From this beginning with the Manhattan Project, the Atomic Energy Act was passed, and on January 1, 1947, the weapons program was established. The Act placed the research, development, testing and production of nuclear weapons under civilian control in the Atomic Energy Commission. Our mission requires that we:

Direct a program of research, development, testing, production, life-time surveillance, and retirement of nuclear weapons.

Direct a program for the prevention of unauthorized nuclear detonations.

Maintain liaison between the DOE and the Department of Defense on nuclear weapons matters.

Administer DOE activities under international agreements for cooperation involving nuclear weapons.

From those beginnings 40 years ago, much has changed in the nuclear weapons program. Today's weapons complex little resembles what we started with 40 years ago—except for the tradition of excellence in meeting our mission goals.

The DOE and its predecessors have been successful in satisfying the singular mission placed upon us. Our national security demands a preeminent level of excellence in scientific innovation and in the production of nuclear weapons to the highest standards of safety, reliability and performance. Scientists, engineers, skilled production workers and managers work closely together to maintain the integrity of the weapons program through the life cycle of each weapon. Decentralized management through government owned, contractor operated laboratories and weapons and materials production facilities provides advanced technology capability not duplicated elsewhere. The three weapons laboratories provide independent judgments, innovative development, design competition and views and insights not available anywhere else in this nation.

WEAPONS COMPLEX FACILITIES

When this program was organized under the Atomic Energy Act nearly 40 years ago, there were three facilities in the nuclear weapons complex: Los Alamos Scientific Laboratory, where we conducted research; a Sandia branch of Los Alamos located in Albuquerque, for ordnance design, development and testing; and the Rock Island Arsenal, which produced the mechanical bomb components.

By the mid-1960's, the weapons complex had reached its peak as far as numbers of facilities were concerned. One of the great strengths of the program was already in place—the government-owned, contractor-operated facilities that I mentioned earlier. Our three nuclear weapons laboratories, Los Alamos, Lawrence Livermore and Sandia, are truly national assets; they have developed some of the finest technical facilities in the world, and bring together the best scientific and technical talent in the nation to work on the challenging national defense problems we face. Our production plants provide a unique capability—manufacturing high technology nuclear weapon components to exacting specifications, using uncommon materials, and re-

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sponding to requirements which, by their nature, push the limits of manufacturing technology.

Today's nuclear weapons complex has fewer facilities than 20 years ago. Since 1964, we have eliminated most of the redundancy in the complex—which has saved us a great deal of money but which leaves us vulnerable if a single facility or production capability within a facility should be shut down for any reason. The nuclear weapons complex of today represents the minimum required to meet our national nuclear weapons requirement.

CHANGING TECHNOLOGY

As much as the weapons complex has changed, so has the product. During World War II, our largest conventional bombs were 5 to 10 ton block-busters with a few tons of high explosive (HE) equivalence. The nuclear bombs dropped on Japan—forty years ago this August—weighed approximately the same, but gave nearly 20,000 tons of high explosive output.

Today, we are developing the W88 warhead for the TRIDENT II MK5 reentry vehicle [deleted] in a weight substantially less than [deleted]. Tremendously significant scientific and engineering achievements, rooted our research and development efforts, made these changes possible. We have made major improvements in yield to volume ratios; better packaging; safer explosives; extended life components, and use control features.

But our adversaries have not been standing still either.

SOVIET MILITARY CAPABILITY

[Deleted.]

The bottom line is that we cannot take chances in this area. We must support a vigorous R&D effort in our national nuclear weapon laboratories. We must maintain our production capabilities.

INVESTMENT STRATEGY

We have an investment strategy for the DOE nuclear weapons complex that seeks to accomplish these goals. To successfully accomplish our mission now and in the future, and to ensure that the complex will remain strong and viable, we must provide sufficient manufacturing capacity to meet current and planned production workload with some backup capability. We must enhance our capability at our national laboratories, maintain an effective stockpile improvement program, employ modern management and manufacturing techniques to increase productivity, and restore and revitalize the physical plant—all with adequate safeguards and security and environmental protection.

As in previous years, the budget request for FY 1986 has been developed in the framework of this investment strategy. This is a lean budget. It represents a responsible balance between current requirements and investments for the future, and the need to control Federal spending wherever possible. The budget request before the Committee is the product of extensive analysis, arduous debate, and difficult choices. It takes into account initiatives that we have undertaken throughout the complex to better manage the resources we have, and to increase our efficiency and productivity. It represents the minimum resources required to do our job in FY 1986. Before I turn to the specifics of the budget request, I would like to highlight some accomplishments, and discuss several special topics.

ACCOMPLISHMENTS

During the past year, we have:

Achieved all assigned nuclear weapon production, retrofit and retirement objectives.

Instituted additional programs in the laboratories and production plants to reduce costs and improve operating efficiency.

Initiated major management improvements to more effectively develop, report, manage and control weapon system costs.

Participated in planning for and conducted 10 emergency response exercises.

Continued cooperative activities with the United Kingdom (U.K.), [deleted].

Completed the DOE Plan to support the Strategic Defense Initiative.

Completed Phase 1 studies for the Small Intercontinental Ballistic Missile and Short Range Attack Missile II weapon systems; completed Phase 2 studies of the Nuclear Depth Bomb for the Anti-Submarine Warhead; initiated Phase 3 Engineering Development of the W88 warhead/MK 5 reentry body for the Trident II.

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Maintained an active underground nuclear test program at the Nevada Test Site, successfully conducting [deleted] test events.

Demonstrated soft x-ray lasers using the NOVETTE laser system.

Completed eight major construction projects, including the world's most powerful laser, NOVA, at the Lawrence Livermore National Laboratory.

We are particularly proud of two specific accomplishments in the areas of operating efficiency and cost management.

Increased Efficiency

The DOE has a strong commitment to reduce costs and improve efficiency throughout the weapons complex. As you know, our Government-Owned Contractor-Operated plants are operated by companies with a long history of successful ownership and operation of their own commercial plants. Cost control and efficiency are important to their commercial operations; these companies apply the same management techniques to the operation of our plants. Nevertheless, we are emphasizing the need for improved cost saving and improved operating efficiencies, and require quarterly reports of cost savings and initiatives from each of our plants. Three examples follow.

Efforts at the Rocky Flats Plant to recycle scrap generated in the manufacture of the aft and center caps of the W80-0 and W80-1 warheads has reduced material requirements, and reduced the per unit cost by [deleted] each; this will result in a savings of about $16 million over the life of these two systems.

The Martin Marietta Corporation and Sandia National Laboratories developed a new process that made more efficient use of a very expensive steel alloy in the B83 bomb. This new process will result in a savings of about $14 million over the life of the B83 bomb program.

Rockwell International installed an automated production scheduling system at Rocky Flats which improves material flow. This system reduced work-in-process inventories by about $16 million.

We have many other initiatives underway including computer integrated manufacturing, acquisition of state-of-the-art capital equipment, and refinement of manufacturing processes to decrease workload costs. All of these efforts taken together will lead to our goal of reducing costs and improving efficiency.

Improved Cost Management

Recent increases in some weapon systems unit costs have shown the need to reemphasize cost management in nuclear weapons design and production activities. We have undertaken an aggressive program to improve cost management in the following areas:

An improved and more formal documentation of military characteristics and stockpile-to-target sequences, and establishment of baseline cost estimates for each weapon system.

A component unit cost reporting system that will provide an analysis of the change in unit cost estimates and a comparison of actual cost performance. This information will form the basis for a more structured review and analysis of weapon system production programs.

A more thorough and comprehensive review of weapon system life-cycle costs provided to the Congress to support the DOE and DOD budget submissions.

The overall objective of the initiative is to have an improved system to develop, manage, and control weapon system costs more effectively.

SPECIAL TOPICS

Radiation Litigation

The Department very much appreciates the action taken by the Congress last year in enacting Section 1631 of the DOD Authorization Act, concerning Radiation Litigation. By providing that the U.S. will be the sole defendant in all pending and future atomic-test cases, Section 1631 recognizes that the contractors involved in the atomic weapons testing program were engaged in unique and clearly governmental activities that made them instruments of national policy. It is only fair that the Federal Government be the party against which any lawsuits involving such activity be brought.

Inertial Fusion Program Review

General consensus has been reached among DOE, the Office of Science and Technology Policy, the Office of Management and Budget, and the Congress on procedures for organizing and conducting the Inertial Fusion program review mandated

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by the FY 1985 Authorization Act. The review will be carried out by the National Academy of Sciences, and general agreement has been reached on the charter, chairman, and membership of the technical review committee. We anticipate that the report of the review group will be useful to the Department and the Congress in determining the future direction of the program.

Artillery Fired Atomic Projectile (AFAP) Production

Section 1635 of the FY 1985 Defense Authorization Act pertains to the modernization of AFAPs. On February 5, 1985, the Secretary of Defense submitted the DOD plan to implement those requirements. The plan calls for the production of a mix of modernized AFAPs not to exceed 925 units. The planned build will produce approximately [deleted] W79 8-inch AFAPs and approximately [deleted] W82 155mm AFAPs. Warheads [deleted] produced after October 19, 1984, the date of enactment of the DOD Authorization Act, will be [deleted] as specified in Section 1635. It is now planned that W79 production will be completed in FY 1986. [Deleted.] The total DOE acquisition costs to be expended for both warheads from October 19, 1984, are estimated to be [deleted] within the $1.1 billion limit included in Section 1635. Costs for maintaining the weapons in the stockpile are estimated to total $1.07 billion over the life of the systems.

With respect to the W82 production program, we have notified the Congress of our intention to initiate product and process engineering and long lead procurements to support the [deleted] initial operational capability for the W82 and included $15.0 million in the FY 1986 budget to finance the construction of production facilities.

[Deleted.] The total estimated cost of the W82 production facilities has been reduced to $40.0 million—$15.0 million appropriated in prior years, $15.0 million requested in FY 1986, and the remaining $10.0 million to be requested in FY 1987. [Deleted.]

Building 371 at Rocky Flats

In 1969, a major fire at the Rocky Flats Plant destroyed most of the plant's plutonium recovery capabilities. In 1982, we completed a new plutonium recovery facility, Building 371, which replaced and enhanced this capability. However, operating experience with the facility has shown that plutonium processing and scrap recovery results do not meet design specifications. Because future plutonium needs are projected to increase, and because DOE desires to minimize or eliminate offsite shipment of plutonium-bearing residue, Building 371 must operate at full efficiency. We have initiated a study of options to address the problem, and the study group's recommendations are expected later this year. Funding for correction of Building 371 deficiencies will be requested in FY 1987 or FY 1988.

I will turn now to a discussion of the FY 1986 budget estimates.

FY 1986 BUDGET REQUEST

The Departmental request for the weapons activities program totals approximately $4.6 billion in new budget authority, an overall increase, including inflation, of about 9 percent above FY 1985 appropriations. This provides for essential effort required to support the research, development, testing, production, and lifetime surveillance of safe and reliable nuclear weapons to meet national defense needs. Inertial fusion research is also included. No supplemental FY 1985 funding is requested.

The budget request is discussed in detail below.

Production and Surveillance

The major portion of the budget request—over $2.6 billion—is provided to produce, maintain, and certify nuclear weapons throughout their lifetime, then to disassemble and dispose of them all in accordance with Presidential direction in response to the Nuclear Weapons Stockpile Memorandum. These Production and Surveillance activities are carried out at seven government-owned, contractor-operated plants throughout the United States that provide for fabrication and assembly of nuclear weapons and weapon components, stockpile maintenance, reliability assessment of the existing stockpile, procurement of non-nuclear materials, and development of processes and techniques required for projected weapon production.

The FY 1986 budget request for Production and Surveillance supports the currently anticipated production schedule. Operating expenses account for $1.94 billion of the budget request, an increase of about $136 million, or about 7.5 percent, over FY 1985. This will support production and delivery of eight weapon types for current stockpile requirements in FY 1986; preproduction activities on the W81, W82, W88

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and Antisubmarine Warfare/Standoff Weapon Warhead (ASW/SOW); and provide for maintenance of the existing stockpile. In FY 1986, the following systems will be in production: the B61-3 and B61-4 bombs, which have been in production for a number of years; the W76 TRIDENT MK-4 warhead, [deleted]; the W79 warhead for the 8-inch Artillery Fired Atomic Projectile; the W80-0 Sea Launched and W80-1 Air Launched Cruise Missiles; the B83 bomb; the W84 warhead for the Ground Launched Cruise Missile; the W85 warhead for the PERSHING II missile, and the W87 warhead for the PEACEKEEPER missile. As discussed earlier, the W79 is in production now, although at a rate lower than previously planned. [Deleted] consistent with the guidance contained in the FY 1985 authorization act.

Funding for capital equipment and general plant projects is increased by about 16 percent to $170 million to slow further deterioration of the capital asset base in the weapons production complex. Capital equipment funds are also provided in support of the Computer Integrated Manufacturing (CIM) initiative underway throughout the complex.

Of the $2.6 billion requested for Production and Surveillance, about $500 million is planned for construction. New projects include the ASW/SOW production facilities at various sites, safeguards and security upgrades, environmental improvements, and a production support project at the Savannah River Plant. The remaining construction funding is required to continue prior-year projects, including two major utility improvement projects in progress at the Pantex Plant.

I would also like to discuss the Utility and Equipment Restoration program, which was begun in FY 1980. As you recall, this program was initiated to redress a decade of underfunding that resulted in the deterioration of the capital assets of the weapons complex.

The initial schedule for completion of the work was set at five years. This schedule was predicated on a specific funding profile to eliminate the existing backlog, and adequate funding for general plant projects (GPP) and capital equipment to halt further deterioration of the capital asset base. Constrained budgets have stretched the initial five year schedule to the currently projected nine year schedule. The total cost of the restoration line item has increased to approximately $1.3 billion in FY 1986 dollars.

We are requestng $480 million to continue the Restoration effort in FY 1986. About $195 million of this total is included in the P&S construction request for the Utility and Equipment Restoration line item, to continue the major construction projects. The overall restoration effort also includes approximately $285 million in basic capital equipment and minor general plant project construction efforts funded in the P&S and RD&T requests. This will cover the annual growth in the inventory of "poor and inadequate" facilities—an inventory which, if unchecked, will accumulate and extend the Restoration program.

Research, Development, and Testing (RD&T)

The research, development and testing budget supports the activities of the three nuclear weapons laboratories and the Nevada Test Site in RD&T, engineering and certification of stockpiled and future nuclear warheads, and the advancement of science and technologies applicable to nuclear weapons. The budget request for research, development and testing includes funding to support laboratory employment and [deleted] underground tests. The Department's efforts in support of the President's Strategic Defense Initiative (SDI) are included in the Research and Development Technology Base activities, and will be discussed separately.

Operating expenses of about $1.5 billion are requested for FY 1986, about half of which is expected to be devoted to technology base activities. Because the Inertial Fusion program is included in the RD&T activities for FY 1986, the funding for technology base activities has actually decreased by about $20 million from the FY 1985 level, with a corresponding decrease in laboratory employment of about 500 full-time equivalents to just over 9,000 in FY 1986.

The technology base provides the fundamental scientific and engineering data bases and facility capabilities for exploration of advanced concepts, supporting research and supporting technologies. During the last several years, new concepts have emerged from the nuclear weapons technology base; its vitality is extremely important to ensure that our stockpile does not become obsolete, and to guard against technological breakthroughs by our adversaries that could possibly degrade our stockpile's deterrent value. Other aspects of the research, development, and testing program include inertial fusion research and research in support of the Strategic Defense Initiative.

Significant technical achievements in recent years have led to inertial fusion research and development activities becoming an important part of the technology

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base for nuclear weapon design and advanced weapon concepts. With the DOD's increasing demands for nuclear weapon development and for proof of advanced concepts, we have found it necessary to review priorities within overall weapons research and development. This committee has indicated to my predecessors that the major facilities developed for inertial fusion should be utilized to the extent possible in addressing nuclear weapon design issues, many of which are also inertial confinement fusion feasibility questions, as well as issues of advanced concept feasibility. We intend to use these facilities to support weapons research to the extent permitted by available resources. Out of total weapons technology base funding of about $730 million, we plan to continue our present inertial fusion research and development activities at a level of about $70 million in FY 1986, a decrease from $154.8 in FY 1985. Within this constrained funding we intend also to [deleted] continue the supporting laboratories' efforts.

Underground nuclear testing is an integral part of the overall research and development process. A total authorization request of $677.6 million supports a balanced program of [deleted] weapon tests that will address basic weapon design physics, development of specific designs for DOD systems, [deleted].

Capital equipment funding for RD&T is requested at $141.5 million, an increase of about 6 percent. The request includes planned increases in capital expenditures for state-of-the-art supercomputers required in all aspects of weapon design. We are attempting to acquire these critically needed machines in the most cost-effective manner.

The FY 1986 RD&T construction authorization request includes $29.9 million for general plant projects, $112.1 million for the continuation of prior-year revitalization projects, $104.3 million for the continuation of five safeguards and security prior-year projects, $25.8 million to continue two other prior-year projects, and [deleted] to initiate design of two new projects.

The Strategic Defense Facility, to be located at Sandia, will provide needed new capabilities to conduct experimental research on advanced defensive and directed energy weapons concepts. The new Decontamination and Waste Treatment Facility at Lawrence Livermore National Laboratory addresses important environmental, safety and health issues.

In FY 1984, we initiated, with your help, a multi-year capital investment effort to provide new or additional capabilities to revitalize the nuclear weapons research, development and testing complex. The RD&T Revitalization program will replace or add to existing facilities that are outdated, deteriorated, overcrowded, or otherwise inadequate to provide the capabilities required to support a vigorous research, development and testing program over the long term. So far, $86.4 million has been appropriated for these projects, and the total cost to complete the program is currently estimated at $1.9 billion over the next 10 years. Funding requested in FY 1986 for the RD&T Revitalization effort totals $96.5 million. This is to continue ongoing projects only—new starts in FY 1986 have been deferred due to budget constraints.

Strategic Defense Initiative

The DOE role in the Strategic Defense Initiative is one of support to the DOD. The SDI-related research, like all of the weapons research and development activities, will be in support of goals set by the DOD. To this end, we have negotiated a memorandum of agreement with the DOD in which we make a commitment to conduct a coordinated, responsive research effort in support of overall SDI program objectives.

The DOE's SDI-related research is carried out primarily in the technology base portion of the weapons research and development program. [Deleted.] These efforts are principally research on nuclear directed energy weapon concepts, carried out at the three national laboratories. [Deleted.]

The level of effort for DOE's SDI-related research in FY 1986 is expected to total about $282 million. [Deleted.]

Program Direction

The Weapons Program Direction request provides funding to support Headquarters and field personnel engaged in general management and direction of the weapons complex, as well as funding for the Community Assistance Program for Los Alamos, New Mexico and Oak Ridge, Tennessee. For FY 1986, the authorization request includes $49.9 million for personnel costs, and $48.8 million for Community Assistance. Of the amount requested for Community Assistance, a lump sum payment in the amount of $41.1 million will liquidate all remaining obligations to Oak Ridge under the Atomic Energy Community Act of 1955. This will provide for an equitable conclusion of the program in Tennessee and will assist the City of Oak

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Ridge, and Anderson and Roane counties in attaining the financial independence for which they have been striving since the inception of the Act.

Finally, I would like to discuss several other issues which cut across program lines. There are two major efforts underway in the nuclear weapons complex to address important aspects of the way we conduct our business. These are (1) Safeguards and Security and (2) Environment, Safety, and Health. We must assure that our facilities are safe, secure and environmentally acceptable.

Safeguards and Security

As you recall from our testimony last year, we have undertaken a substantial effort to assure that the weapons complex has an adequate defense against possible acts of theft, diversion, sabotage, terrorism, and other acts which could interrupt the workings of the nuclear weapons complex or endanger our citizens. We are striving to attain a posture that will preclude intrusion on any of our sites. We are devoting considerable resources in FY 1985 to expand our guard forces further, improve training, and provide better equipment and facilities to enhance protection capabilities based on each site's requirements. We plan to continue these efforts in FY 1986.

The FY 1986 authorization request for safeguards and security construction at weapons complex sites is $126.5 million. This will permit the initiation of two new construction projects—one at the Pantex Plant and the other at the Mound Plant, totaling $4.5 million, with the balance of the FY 1986 request of $122.0 million continuing nine prior-year construction projects at various weapons complex sites.

The largest portion of the request for prior-year projects is $45.4 million for the Combined Device Assembly Facility at the NTS. This funding will initiate the construction phase of this important project. The project provides a 124,000 square foot facility within a 50-acre, high security area in a central portion of the NTS. The purpose of the facility is to consolidate all DOE nuclear test device assembly functions in a safe and secure facility which meets current standards for assembly of nuclear materials and high-explosive operations.

Environment, Safety and Health (ES&H)

A related initiative is also underway for ES&H issues. Emphasis on environmental protection requirements by Federal, State and Local agencies has increased substantially in the past few years. Earlier environmental protection standards have been tightened. Previously acceptable methods for storage and disposal of waste products are no longer acceptable. We must take a responsible approach to compliance with the new standards—one which balances the best methods of hazardous materials disposal with adequate protection for our employees and our neighbors. We are developing long range plans to address these problems, and we are setting priorities to accomplish our goals in a balanced, cost-effective manner.

The authorization request is $31.2 million in construction funding for ES&H activities to continue two major ES&H projects currently in progress and begin design and construction on three new projects, one in Research and Development and two in Production and Surveillance.

Before I summarize, I would like to address one additional topic which has become very important to us in the Department's Weapons Activities program.

BLUE RIBBON TASK GROUP

In the FY 1985 Defense Authorization Act, the Congress requested that the President establish a Blue Ribbon Task Group to examine the procedures used in establishing requirements and providing resources for the nuclear weapons program, and to recommend any needed changes in such procedures. The Task Group was initiated because of concerns that DOE-produced weapons were "free" to the DOD without consideration of resources and tradeoffs; that conventional weapons are not given due consideration; and that nuclear weapons tend to be overly complex and costly. These concerns should be considered by the Task Group.

The President is to provide a detailed plan to your committee on the composition and conduct of the Blue Ribbon Task Group. The Task Group is to forward a report to the President and the Congress that will contain findings and recommendations in the following areas:

Ways to improve coordination between the DOE and Department of Defense to ensure cost-effective implementation of weapon activities and materials production.

Cost effective improvements that can be made in budgeting and management procedures that affect weapons activities and materials production.

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Whether DOD should assume the responsibility for funding current DOE weapon activities and materials production programs.

Previous studies on this subject essentially substantiated the central thrust of the Atomic Energy Act. Chief among these were the 1976 Funding and Management Alternatives for ERDA Military Application and Restricted Data Functions study, commonly referred to as the "Transfer Study", and the July 1980 Long Range Nuclear Weapon Planning Analysis, called the "Starbird Study". Each study affirmed the quality of the laboratories and production complex, and recognized the uniqueness of the program. At the same time, however, the studies recommended actions for strengthening the acquisition and funding process. The Blue Ribbon Task Group provides another opportunity to examine new approaches and different methods of reviewing resources necessary for developing nuclear weapons.

The integrated and independent DOE nuclear weapons enterprise has shown singular competence in responding to the nation's vital defense requirements. Any changes which may be proposed by the Blue Ribbon Task Group must be carefully examined to ensure that they do not dilute the existing strengths of the nation's nuclear weapons enterprise.

Over a 40-year period, this enterprise has: Successfully provided this country's ultimate defense—its nuclear deterrence. Provided the highest level of scientific innovation, which has resulted in the U.S. lead in nuclear weapons technology. Maintained a high level of confidence in the safety and reliability of nuclear weapons. Had the flexibility to respond quickly to new requirements.

This record is a result of strengths within the enterprise, strengths which include: Independent, creative design laboratories. Competent government-owned contractor-operated production facilities, capable of technological performance not found elsewhere in U.S. industry. A decentralized yet integrated system, in which design laboratories, production facilities, and government management work closely together to achieve their common purpose. Independent views and approaches to weapons design and nuclear safety.

We will increase our cost and resource tradeoff interactions with DOD on the basis of procedural changes recently initiatied but not yet brought to fruition. We will continue to improve internal management techniques for cost effective utilization of resources.

SUMMARY

In closing, Mr. Chairman, I would like to emphasize that our budget as presented to you today is lean. It supports the DOE-DOD plan proposed to the President in the Nuclear Weapon Stockpile Memorandum. It continues the Restoration program, to preserve our capital assets. It includes small increases for GPP and capital equipment to slow deterioration, and it supports our commitment to an appropriate level of safeguards and security and environmental protection at our sites.

Due to overall Federal budget constraints, however, the budget provides for only two new starts for programmatic facilities and includes no new RD&T revitalization projects. Our requests for capital equipment and GPP are less than we would like—or need—to really stop the deterioration of the capital asset base. There are increased demands on our R&D Technology Base funding, but yet there is a net decrease in laboratory manpower. We also expect that the weapons program will have to absorb a greater percentage of laboratory overhead due to significant reductions in DOE's energy programs.

Notwithstanding all of this, we remain upbeat. The nuclear weapons program has combined the best attributes of American industry, academia, and government to accomplish singular program objectives with unparalleled excellence. The weapons program will continue to strive for excellence, look for new ideas, and improve its operations. We will continue to seek new and creative approaches to resolve issues while, at the same time, preserving and maintaining the strengths of the present program. We accept this challenge.

Thank you for the opportunity to speak with you today. I would be happy to answer any questions you may have concerning the Department's Weapons Activities program.

PREPARED STATEMENT OF RONALD W. COCHRAN, DEPUTY ASSISTANT SECRETARY FOR NUCLEAR MATERIALS, DEPARTMENT OF ENERGY

Mr. Chairman and Members of the Committee. It is a pleasure to present the FY 1986 budget for the Department of Energy's Nuclear Materials Program. This program is made up of two major components—materials production to meet the na-

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tion's nuclear weapons needs and defense waste management to ensure that our waste is stored or disposed of in a safe and environmentally acceptable manner.

CHART 1

FY 1986 BUDGET REQUEST
(DOLLARS IN MILLIONS)

	FY 1985 AUTHORIZATION	FY 1986 AUTHORIZATION REQUEST
MATERIALS PRODUCTION	$1,745.0	$1,965.4
DEFENSE WASTE AND BYPRODUCTS MANAGEMENT	$ 721.6	$ 712.8
TOTAL	$2,466.6	$2,678.2

Chart 1 shows the Nuclear Materials' FY 1986 Authorization Request for $2.68 billion, which includes $1.97 billion for Nuclear Materials Production, and $.71 billion for Defense Waste and Byproducts Management.

I would first like to discuss the Nuclear Materials Production Program and then address the Defense Waste and Byproducts Management Program.

NUCLEAR MATERIALS PRODUCTION PROGRAM

INTRODUCTION

CHART 2

OBJECTIVE

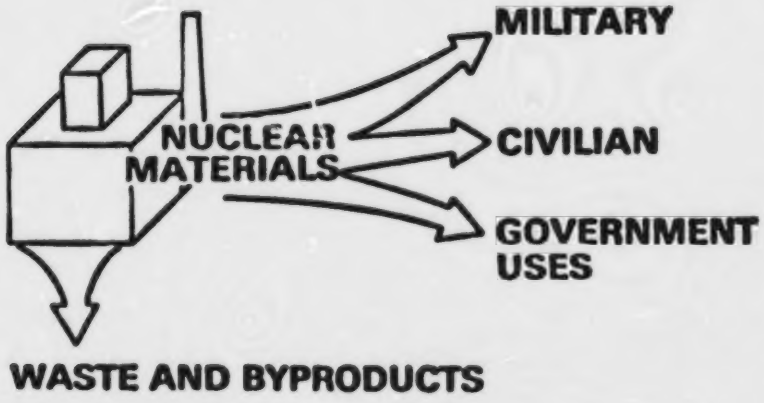

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Chart 2 shows the objectives of the Nuclear Materials Production Program. The major objective is to provide nuclear materials for national defense requirements. The program is also responsible for producing nuclear materials for use in government research and development, and civilian programs which use radioisotopes for research, commercial, and medical applications.

The Nuclear Materials Production Program provides materials which are essential to the development, production, and maintenance of nuclear weapons. We produce these materials in the Department's nuclear reactors and convert them into useful form in the Department's processing plants. These dedicated facilities are the sole source of tritium and plutonium in the United States to meet national defense nuclear materials requirements.

Nuclear Materials Requirements

The Nuclear Materials Production budget is primarily based upon the requirements for tritium, plutonium and enriched uranium set forth in the Nuclear Weapons Stockpile Memorandum (NWSM) approved annually by the President. The NWSM consists of the Nuclear Weapons Stockpile plan for the current and next 5 fiscal years (FY 1985–FY 1990), a planning projection for the subsequent 5-year period (FY 1991–FY 1995) and a long-range summary for nuclear materials planning for 5 additional years (FY 1996–FY 2000). The President annually issues a National Security Decision Directive approving the Nuclear Weapons Stockpile Plan and noting the planning projection and long-range summary as points of departure for future stockpile plans. These forecasts are based on projected military needs as well as our ability to respond to those needs.

Chart 3 [Chart deleted] shows the total amount of plutonium and tritium expressed as the weighted sum in "plutonium equivalents," excluding decay and waste losses, needed to satisfy the projected weapons requirements.

[Deleted.] Much of the plutonium and tritium required for building new warheads and replacing decay losses is obtained by reclaiming and recycling materials from retired weapons returned by the Department of Defense (DOD) to the Department of Energy (DOE). Material requirements which cannot be met from DOD returns or existing DOE inventories must be satisfied by new production. [Deleted.] We expect to meet these requirements through FY 1990, provided we have no serious problems with our production facilities or our planned production initiatives. [Deleted.]

Restarting the L Reactor at our Savannah River, South Carolina, facility and blending to utilize inventories of low-grade plutonium are the primary new contributing initiatives during the directive period. Higher productivity cores at Savannah River as well as special isotope separation technology and/or continued blending can make additional significant contributions during the planning period. [Deleted]

Nuclear Materials Production Rates

Chart 4 [chart deleted] shows the cumulative plutonium and tritium supply and demand expressed in plutonium equivalents, excluding decay and waste losses, over the 16-year planning span of the Nuclear Weapons Stockpile Memorandum based on the FY 1986 budget. [Deleted.]

Charts 5 and 6 [charts deleted] show the projected annual production rates by source of plutonium equivalent through the planning period. The increase in production you see here is due largely to the production initiatives started in FY 1981—efforts this committee has strongly supported. [Deleted.] Among the initiatives which can contribute to the rise in production are blending to utilize inventories of low-grade plutonium, facilities restoration, conversion of N Reactor to production of weapon-grade plutonium, reactivation of the PUREX fuel processing plant, restart of L Reactor, higher productivity cores in our Savannah River Plant reactors, and special isotope separation. Chart 5 is based on production deployment of the special isotope separation technology. Chart 6 is based on continued blending without special isotope separation. These increases in production will permit us to meet the projected requirements of the nuclear weapons program until the late 1990's [deleted]. I will discuss the materials production initiatives in more detail later.

Charts 7 and 8 [charts deleted] show a slightly different perspective on nuclear materials supply and demand. The top solid line represents total supply available and the dashed line represents net expected demand. [Deleted.] The other solid lines represent the cumulative contributions of the various production capabilities and illustrate the importance of keeping the initiatives on schedule. Chart 7 is based on production deployment of special isotope separation technology. Chart 8 is based on continued blending without special isotope separation.

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Chart 9 [chart deleted] shows the relative product costs from supply options currently available or planned. In general, the incremental plutonium production which the new initiatives provide is considerably less costly than base plutonium production from the four currently operating production reactors.

Comparison of U.S. and U.S.S.R. Production

Our historical annual rate of production (plutonium equivalents) is shown in Chart 10. [Chart deleted.] When production scale activities were initiated in the 1940's, the production complex produced [deleted] plutonium equivalent per year. In the late fifties and early sixties, when we were operating up to 13 reactors, U.S. plutonium equivalent production reached a peak [deleted]. During the 1960's, many production reactors were shut down. Through the seventies, we produced less [deleted].

Highly Enriched Uranium

I also want to mention the supply of highly enriched uranium for U.S. weapons. The U.S. weapons program has operated within its existing inventory of enriched uranium for the last 20 years without having to obtain additional material from the uranium enrichment complex. This has been accomplished by recycling enriched uranium from retired warheads. Although recycling continues, the supply of highly enriched uranium is decreasing due to utilization in weapons tests, production reactors and research reactors. A need for additional quantities of highly enriched uranium is projected for the weapons program starting as early as FY 1988 as shown on Chart 11. [Chart deleted.] Uranium feed required to produce the highly enriched uranium needed for Defense Programs activities can be provided from DOE's existing inventory, at least through Year 2000, through a combination of utilizing natural uranium feed and recycling partly depleted uranium "tails." It will be necessary to significantly increase the highly enriched uranium production capacity and reestablish the supporting uranium hexafluoride to uranium tetrafluoride conversion capability which can be done at a cost of approximately $30 million. This additional capacity would allow DOE to meet existing Naval Reactors program requirements as well as the projected weapons program requirements.

Production Process and Materials Flow

Before I get into the details of our request, I would like to describe, using Chart 12, the DOE defense nuclear fuel cycle and its associated facilities.

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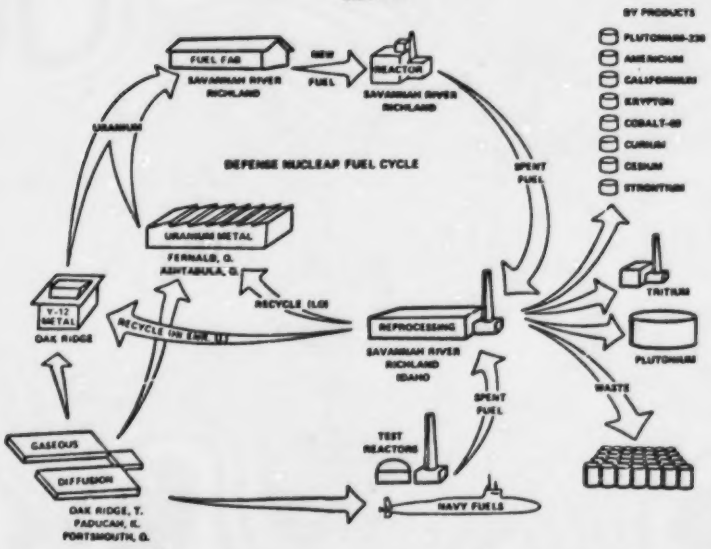
CHART 12



The gaseous diffusion plants provide uranium of the proper enrichment levels to the feed material facilities. These facilities produce uranium metal which is transported to Savannah River or Richland where it is fabricated into fuel or targets for use in the reactors. The uranium fuel comes from four sources: (1) slightly enriched and highly enriched uranium recycled from irradiated defense production reactor fuel; (2) highly enriched uranium recovered from spent Navy and research reactor fuel at Idaho and processed into usable form at Oak Ridge; (3) highly enriched uranium stockpiled at the Oak Ridge Y-12 plant; and (4) new slightly enriched uranium obtained from the DOE enrichment plants.

Our Savannah River reactors can produce both plutonium and tritium. For plutonium, the reactors use about 60 percent enriched uranium in the fuel rods to drive the reactors and irradiate depleted uranium target rods to produce plutonium. The basic nuclear process for producing plutonium-239, as shown in Chart 13, is the capture of a neutron by uranium-238 to give uranium of atomic weight 239 which, within a few days, decays by electron emission to plutonium-239.

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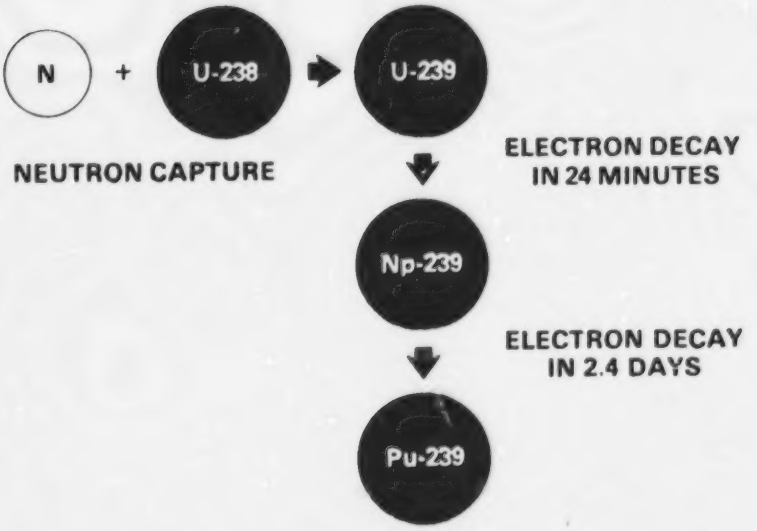
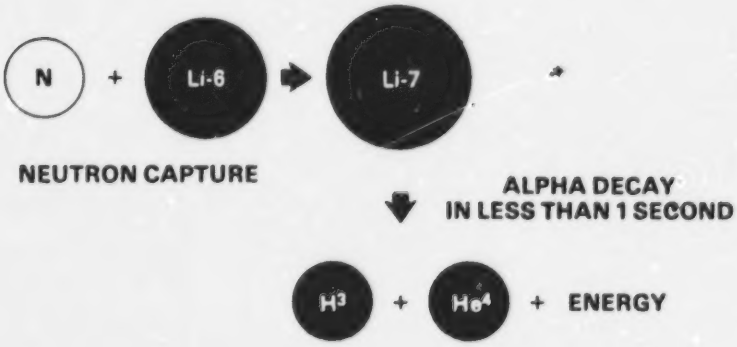
Chart 13



To produce tritium, lithium targets are irradiated, rather than depleted uranium targets. The basic nuclear process for producing tritium, (hydrogen-3), as shown in Chart 14, is the capture of a neutron by lithium-6 to form lithium-7 which decays rapidly to produce tritium and helium as byproducts. [Deleted.]

Chart 14



The N Reactor on the Hanford site at Richland uses about 1 percent slightly enriched uranium to fuel the reactor and produce plutonium. The spent fuel from N Reactor is processed at the PUREX fuel processing plant to recover both the produced plutonium and the remaining uranium. After being in standby since 1972,

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PUREX was reactivated in November 1983, 5 months ahead of schedule. We are very grateful for the strong support this Committee provided to enable us to achieve that important milestone.

Idaho receives, stores, and processes fuels principally from Navy propulsion reactors for the recovery of residual enriched uranium. The recovered uranium is used as fuel for the Savannah River reactors.

The material flow which I have just described involves large facilities at six field sites. These sites comprise about 1,850 square miles of land and employ about 14,600 people. These six production sites, shown in Chart 15, are located at Savannah River, South Carolina; Richland, Washington; Idaho Falls, Idaho; Oak Ridge, Tennessee; and Fernald and Ashtabula, Ohio. Lawrence Livermore National Laboratory and Los Alamos National Laboratory carry out production related research and development and material processing activities.

CHART 15

NUCLEAR MATERIALS PRODUCTION SITES

SUMMARY BUDGET REQUEST

Before continuing with discussion of the production activities, I would like to point out that the Nuclear Materials Production Program is providing special emphasis to two important crosscutting areas as shown in Chart 16.

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CHART 16

NUCLEAR MATERIALS PRODUCTION
FY 1986 BUDGET REQUEST COMMITMENTS

- **ENVIRONMENTAL IMPROVEMENTS**
- **SAFEGUARDS AND SECURITY IMPROVEMENTS**

Commitment to Priority Environmental Improvements

DOE is committed to taking those actions necessary to comply with applicable State and Federal environmental regulations. In particular, compliance actions are underway to meet the requirements of the Resource Conservation and Recovery Acts, the Clean Water Act, and the Comprehensive Environmental Response Compensation and Liability Act.

It is the policy of the Department of Energy to operate the production complex in an environmentally acceptable manner while providing nuclear materials required for national defense. The FY 1986 budget request for environmental activities continues this emphasis and commitment and provides for the beginning of new long-term solutions for priority problem areas.

Commitment to Safeguards and Security Improvements

A heightened sense of priority has been given to: (1) evaluations of the remaining security vulnerabilities at key DOE weapons and research facilities; (2) more comprehensive, integrated planning for safeguards and security activities and improvements; and (3) more effective operations of safeguards and security systems, including performance testing of such systems. This increased priority is due principally to the need for improvements identified as the result of inspections and investigations by: (1) the DOE headquarters and field offices; (2) the DOE Inspector General; (3) the General Accounting Office; and (4) various Congressional committees. The heightened sense of priority also results from the increase in the international terrorist threat to U.S. interests. Not only might such groups be interested in nuclear materials or fabricated nuclear weapons, they or their supporters might be interested in acts of sabotage against key nuclear weapons facilities to disrupt or damage the weapons production capability of the U.S.

These potential threats, as well as inspections and investigations, have focused management attention on the priority need for increased funding to improve the security of key DOE facilities and to provide adequate safeguards for special nuclear materials. These cost increases are partially due to the need for tactical response forces including SWAT (Special Weapons and Tactics) teams equipped with automatic weapons, grenades, armored vehicles, helicopters, and secure communications as well as the additional well-qualified guard force personnel and more intensive, continuous training that such teams require. Additionally, we are replacing obsolete alarm system components and nuclear material measurement systems.

We continue to believe that it is essential to national security and the protection of public health and safety to improve the state of safeguards and security at our vital facilities. The safeguards and security budget for FY 1986 has been formulated as part of an agency-wide effort to maintain the momentum of previous years and to correct remaining deficiencies. Continued funding is essential in our efforts to establish continued effective safeguards and security.

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Turning now to the FY 1986 budget as shown in Chart 17, we are requesting authorization of $1,965,400,000 in support of Nuclear Materials Production activities.

CHART 17

NUCLEAR MATERIALS PRODUCTION
FY 1986 BUDGET REQUEST
(DOLLARS IN MILLIONS)

	FY 1985		FY 1986 REQUEST	
	AUTH.	APPROP.	AUTH.	APPROP.
OPERATING EXPENSES				
REACTOR OPERATIONS	$ 536.2	$ 535.9	$ 586.4	$ 586.4
PROCESSING OF NUCLEAR MATERIALS	439.8	439.8	493.1	493.1
SUPPORTING SERVICES	253.0	253.0	256.6	256.6
PROGRAM DIRECTION	20.3	20.3	21.3	21.3
URANIUM ENRICHING	142.8	142.8	258.9	258.9
TOTAL OPERATING EXPENSES	$1,392.1	$1,391.8	$1,616.3	$1,616.3
CAPITAL EQUIPMENT	117.7	117.5	123.4	123.4
CONSTRUCTION	235.2	243.0	225.7	237.5
GRAND TOTAL	$1,745.0	$1,752.3	$1,965.4	$1,977.2

Chart 18 shows the major reasons for our increase in authorization over FY 1985. The majority of the increase can be attributed to escalation on our on-going activities and the [deleted] Naval reactor uranium requirements, which I will discuss in more detail later.

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CHART 18

NUCLEAR MATERIALS PRODUCTION
CHANGES FROM FY 1985 AUTHORIZATION (DOLLARS IN MILLIONS)

FY 1985 AUTHORIZATION	$1,745.0
• ESCALATION	+ 74.7
• FY 1985 BASE PROGRAM CONTINUATION INCLUDING REACTOR OPERATIONS, PROCESSING, SUPPORT FACILITIES, SAFETY, SECURITY, ENVIRONMENTAL, ETC.	– 24.4
• NUCLEAR MATERIAL PRODUCTION INITIATIVES INCLUDING – SPECIAL ISOTOPE SEPARATION – PROCESS FACILITY MODIFICATIONS – SAVANNAH RIVER FUEL IMPROVEMENTS – HIGH PRODUCTIVITY CORES – REACTOR PRODUCTION ASSURANCE ACTIVITIES	+ 23.2
• MAINTENANCE, RESTORATION, AND PRODUCTIVITY RETENTION PROJECTS	+ 24.7
• NAVAL REACTORS URANIUM REQUIREMENTS	+ 122.2
FY 1986 DEPARTMENTAL AUTHORIZATION REQUEST	$1,965.4

The highlights of our FY 1986 request are shown in Chart 19.

CHART 19

NUCLEAR MATERIALS PRODUCTION
FY 1986 BUDGET REQUEST HIGHLIGHTS

- CONTINUES CURRENT PRODUCTION BASE ACTIVITIES IN FY 1986
- SUPPORTS PRODUCTION INITIATIVES BEGUN IN PREVIOUS YEARS
  - FUNDS FACILITY RESTORATION AND IDAHO RESTORATION PROGRAMS
  - FUNDS L REACTOR OPERATION AT SAVANNAH RIVER
  - CONTINUES HIGH PRODUCTIVITY CORE ACTIVITIES
  - CONTINUES SPECIAL ISOTOPE SEPARATION DEVELOPMENT PROGRAM
  - CONTINUES REACTOR PRODUCTION ASSURANCE ACTIVITIES
- FUNDS URANIUM ENRICHING SERVICES TO MEET MATERIALS PRODUCTION AND NAVAL REACTORS REQUIREMENTS AND A 3 MONTH WORKING INVENTORY OF SEPARATIVE WORK
- FUNDS ACTIVITIES NECESSARY TO MITIGATE SECURITY AND ENVIRONMENTAL CONCERNS

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Chart 20 shows a crosscut of our budget request broken down into Base Activities, Production Initiatives, and Naval Reactor support. I will now address each in detail.

CHART 20

NUCLEAR MATERIALS PRODUCTION
FY 1986 BUDGET SUMMARY
(DOLLARS IN MILLIONS)

	FY 1985		FY 1986 REQUEST	
	AUTH.	APPROP.	AUTH.	APPROP.
BASE ACTIVITIES				
CURRENT OPERATIONS	$1,231.0	$1,217.4	$1,267.3	$1,296.8
L REACTOR	43.3	43.3	60.7	60.7
SECURITY	142.4	138.0	127.8	139.8
SUBTOTAL	$1,416.7	$1,398.7	$1,455.8	$1,487.3
PRODUCTION INITIATIVES				
RESTORATION	$ 78.9	$ 82.9	$ 51.7	$ 47.7
IDAHO RESTORATION	15.5	15.5	20.1	20.1
PRODUCTIVITY RETENTION	0.0	0.0	28.2	28.2
REACTOR SAFETY	25.0	36.3	23.1	24.9
HIGH PRODUCTIVITY CORES	0.9	0.9	12.0	12.0
SPECIAL ISOTOPE SEPARATION	69.0	69.0	80.0	80.0
PROCESS FACILITY MODIFICATIONS	9.5	19.5	39.2	21.7
NPR/REACTOR PROD ASSURANCE	8.5	8.5	6.1	6.1
SUBTOTAL	$207.3	$232.6	$248.9	$240.7
OTHER				
NAVAL REACTOR SUPPORT	$ 121.0	$ 121.0	$ 249.2	$ 249.2
TOTAL MATERIALS PRODUCTION	$1,745.0	$1,752.3	$1,965.4	$1,977.2

BASE ACTIVITIES

The major component of our request is for base activities as shown in Chart 21, which include facilities currently scheduled to be operating for the production of nuclear materials as contrasted to initiatives which will increase materials production capacity and assure long-term operations of the Materials Production complex. Of the authorization amount, $1,455,800,000 is needed to support base activities in FY 1986.

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CHART 21

NUCLEAR MATERIALS PRODUCTION
FY 1986 BUDGET REQUEST
BASE ACTIVITIES

- **CURRENT OPERATIONS**
  - 3 REACTORS, 2 CHEMICAL PROCESSING CANYONS AT SAVANNAH RIVER
  - N REACTOR AT RICHLAND
  - CHEMICAL PROCESSING PLANT AND FLUORINEL DISSOLUTION AND STORAGE FACILITY AT IDAHO
  - FEED PRODUCTION PLANTS AT FERNALD AND ASHTABULA, OHIO, AND OAK RIDGE, TENNESSE
  - BLENDING
  - PUREX FUEL PROCESSING PLANT
  - ENVIRONMENTAL PROTECTION
- **L REACTOR**
- **SECURITY**

Current Operations

Meeting the objectives of the program requires operation of the four Savannah River reactors to produce tritium and high-purity plutonium for blending; operation of the Richland N Reactor to produce weapon-grade plutonium; operation of two chemical processing facilities at Savannah River, one at Richland, and one at Idaho; operation of reactor feed materials and fuel fabrication facilities at Fernald, Ashtabula, Oak Ridge, Richland, and Savannah River; ongoing security and environmental protection improvements; ongoing process development activities; and operation of utilities and other site support facilities. The base program also supports processing of the Naval and research and development reactor spent fuel returned to Idaho, recovery and processing of scrap nuclear materials to supplement new production, and supporting other Department, government, and industry requirements. Considerable funding is required for maintenance and equipment replacement needed to operate these aging facilities in a safe, secure, efficient and environmentally-acceptable manner.

In FY 1986, the new spent fuel receiving and dissolution processing facility at Idaho will begin full-production processing of irradiated fuels. Subsequently, the recovered uranium from this process will be returned to Oak Ridge to meet defense program needs.

In addition to the production of weapon-grade plutonium directly in reactors, weapon-grade plutonium can be made available by blending high purity plutonium with lower grade—fuel-grade—plutonium. Although the Richland N Reactor is now operating to produce weapon-grade plutonium, during much of the time when the PUREX fuel processing plant was on standby, N Reactor was operated to produce fuel-grade plutonium. This stored material is now being processed and the plutonium obtained is being blended with high purity plutonium currently being produced at the Savannah River Plant to increase the supply of weapon-grade plutonium. Not all of the PUREX capacity is required to provide fuel grade plutonium for blending at the Savannah River Plant. PUREX is also processing fuel containing weapon-grade plutonium which is currently being produced in N Reactor. The combined fuel-grade processing for blending at the Savannah River Plant and weapon-grade

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processing for direct use at Rocky Flats maximizes the total plutonium production for Defense Programs.

[Deleted.]

The funding request for PUREX is higher in FY 1986 than FY 1985 because of increased material throughput. In FY 1986, both fuel-grade and weapon-grade plutonium will be processed. [Deleted] plutonium will be processed in PUREX during FY 1986 than during FY 1985. The processing of the stored backlog of spent N Reactor fuel is planned to be completed by the end of the 1980's.

To enhance and broaden the nuclear materials production capability in the near term, the Department is considering restarting the 175 megawatt Engineering Test Reactor (ETR) at the Idaho National Engineering Laboratory for the production of isotopes for special defense applications. The ETR has been in standby condition since 1981. Restarting the ETR could supplement reactor production capacity at Savannah River and Richland for defense nuclear materials, particularly small quantities needed for special applications.

In FY 1986, we plan to continue the environmental work required at nuclear materials production sites. Additional emphasis will also be placed on programs to prevent future contamination of the environment.

The FY 1986 request provides funds for environmental activities at the Savannah River Plant including: (1) elimination of the potential for future contamination of ground and surface waters from radioactive and hazardous industrial waste discharges; (2) expanded monitoring, evaluation and cleanup of ground water contamination; (3) engineering studies on deactivating and decontaminating the chemical separations area seepage basins; and (4) thermal mitigation of reactor cooling water discharges. These activities are consistent with the Groundwater Protection Plan for the Savannah River Plant, which was submitted to the Congress in FY 1984 pursuant to Public Law 98-181.

Activities to be funded will include completion of the ongoing comprehensive study of the environmental effects of Savannah River Plant cooling water discharges and withdrawals as well as the evaluation of alternative cooling methodologies. Conceptual designs for facilities to mitigate reactor cooling water thermal effluents will also be evaluated.

In order to retire and decommission the Savannah River Chemical Separations Area seepage basins and eliminate future groundwater contamination problems, the request includes an FY 1986 project for construction of an effluent treatment facility to treat radioactive and hazardous discharges.

L Reactor

Our FY 1986 request includes funding for operating L Reactor at the Savannah River Plant. The program to upgrade L Reactor was initiated in FY 1981 and reactor renovation was completed in October 1983, on schedule. This reactor is currently scheduled to begin operating in September 1985 following construction of a lake to mitigate thermal discharges from the reactor. [Deleted.] It is extremely important to restart L Reactor and bring it to full operation as soon as feasible.

Security

In FY 1986 we plan to continue priority security improvements to address needs identified by recent Departmental assessments.

Emphasis will include improvements to: (1) the detection and deterrence capabilities against both inside- and outsider threats; (2) our ability to respond to acts of sabotage, terrorism, theft, or other disruptive acts; (3) equipment and instrumentation; and (4) personnel training.

Continuing security projects funded in FY 1986 include: (1) a computerized nuclear-material vault system at Richland, Washington; (2) a security systems upgrade at Idaho; and (3) a project at Savannah River aimed at eliminating site-wide security deficiencies. New in FY 1986 is funding for the construction of a central alarm, control and communication system at the Savannah River Plant. [Deleted.]

PRODUCTION INITIATIVES

The Production Initiatives are listed in Chart 22.

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CHART 22

NUCLEAR MATERIALS PRODUCTION
FY 1986 BUDGET REQUEST
PRODUCTION INITIATIVES

- RESTORATION PROGRAM
- IDAHO RESTORATION
- PRODUCTIVITY RETENTION
- REACTOR SAFETY
- HIGH PRODUCTIVITY CORES
- SPECIAL ISOTOPE SEPARATION
- PROCESS FACILITY MODIFICATIONS
- REACTOR PRODUCTION ASSURANCE ACTIVITIES

Restoration Program

The facilities restoration program is in the sixth year of a seven-year funding schedule. This program includes the highest priority items to restore the production capability of much of the complex which diminished during the 1970's. Your continued support of the restoration program is vital since we cannot achieve our production goals without a reliable, fully-functioning production complex.

Design and construction efforts are proceeding satisfactorily at all four sites and many of the subprojects funded early in the program have already been completed. The last restoration subproject is expected to be completed by September 1988.

Our authorization request of $51,700,000 will allow those subprojects already underway to be continued.

Idaho Restoration

Facilities at the Idaho site are not included in our Restoration Program. However, spent fuel returns from the Navy are scheduled to double by 1992 and continue increasing through the year 2000. Our requested funding for FY 1986 will allow the continuation of the design work begun this year and the initiation of procurement and construction activities. The Idaho restoration project is required to increase capacity and ensure reliability sufficient to process the scheduled fuel returns. The enriched uranium recovered at Idaho is cost beneficial to the operation of the Savannah River production reactors since it greatly reduces the amount of new highly enriched uranium required.

Productivity Retention

Our FY 1986 request includes $28,200,000 to initiate a new construction line item—the Productivity Retention Project—to further improve and sustain the high operating availability and efficiency of the production facilities at Savannah River, South Carolina; Richland, Washington; and Fernald, Ohio.

Materials throughput rates at these three plants have more than doubled over the past 5 years as the result of increased production demands. This greater throughput

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has caused many older components and systems to reach the end of operational life with resulting increases in downtime and higher operating expenses. If future nuclear materials requirements are to be achieved in a cost effective manner, a relatively broad program must be undertaken to forestall equipment failures, reduce the excess maintenance times that are keeping needed units off-line, and replace out-moded inefficient components.

The total cost of these required productivity improvements will be $550 million. Work will be done in five separate phases with the content of each phase established by schedule urgency. Phase I, which is being introduced in FY 1986, consists of 12 subprojects costing $210.5 million.

While all 12 subprojects cannot be covered in the time available today, I would like to briefly discuss 2 of the subprojects to be performed to illustrate the scope of the project.

The first of these is replacement of the thermal diffusion columns at Savannah River. The thermal diffusion columns are used to purify tritium which has been extracted from reactor targets. [Deleted] parts have been taken from the broken units in an attempt to keep the remaining columns in service. [Deleted.]

We are proposing to replace this obsolete equipment with a newly developed thermal absorption cycle process. This new process will cost $3.8 million less to construct than an identical replacement, require less space, provide higher capacity, reduce tritium losses to the environment, and improve product purity.

A second representative task is refurbishment of the N Reactor V-11 control valves at Richland. A total of 1003 of these valves are used in the reactor to throttle coolant flow during fuel charging and discharging. The valve discs have become badly pitted as the result of over 20 years of service and are eroded completely through on the edges where they are exposed to the greatest hydraulic force. Larger pieces of the disc will begin to break off in the near future. These pieces will be carried downstream and are likely to become lodged in a flow monitoring venturi or fuel element. Either will cause the reactor to shut down with resulting losses of production and steam revenue.

Reactor Safety

Authorization of $23,100,000 is being requested to continue activities begun in FY 1981 to enhance the operating safety of our production reactors at Savannah River and Richland. Our objective is to reduce the risk of accidents, enhance safe operations, and improve our capability to manage emergency conditions. The requested funding will be used to: train reactor operators through computer simulation of normal and off-normal reactor operations; conduct nondestructive tests of reactor internals; improve computerization and reactor coolant instrumentation; and conduct engineering safety studies. The reactor safety project also provides for remote control systems and reactor control room habitability modifications.

High Productivity Cores

An enriched/normal test charge (Mark 22S/25) will be fabricated in FY 1986 for irradiation in FY 1987. If successful, the Mark 22S/25 has the potential for increasing the level of plutonium equivalent production [deleted] over the current Mark 16/31 mode of production in the Savannah River reactors. In addition, the new lattice offers some further safety advantages over the current Mark 16/31 mixed lattice. This is a lower cost alternative to the previous Mark 15 program that we had requested in prior budgets.

Special Isotope Separation (SIS)

The FY 1986 budget provides $80,000,000 in authorization for continued engineering development of the Atomic Vapor Laser Isotope Separation (AVLIS) process at the Lawrence Livermore National Laboratory. This request will also provide for continuation of the conceptual design of the support processing facilities and equipment needed for an AVLIS production capability at the Hanford site. The request will enable the Lawrence Livermore National Laboratory to continue engineering development of plant laser and separator systems directed toward the demonstration of [deleted] plutonium separations in FY 1987. Additionally, the funding request will provide for continuation of the design, fabrication and testing of a prototypical multipod "cold" separator system at the Hanford site, including remote handling and transport equipment. This will allow a longer period for AVLIS process development while maintaining the option to initiate construction of an SIS production facility at Hanford in FY 1987 to achieve a production capability in the early 1990's.

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Process Facility Modifications

The Process Facility Modifications Project at the Hanford site will add to the existing PUREX fuel processing facility the capability for processing and recovering plutonium from DOE-owned fuels, e.g., Fast Flux Test Facility (FFTF) fuel. In addition, we propose to increase the initial scope so the project will provide the capability to process Richland's N Reactor spent fuel in a more cost effective manner than in the existing headend portion of PUREX. By 1990, FFTF spent fuel containing plutonium with a replacement value to Defense Programs of over $1 billion will be available for processing. Payback of the capital and operating costs will occur in 1 to 2 years, depending on the facility's operating modes.

Reactor Production Assurance/New Production Reactor (NPR)

The need for new or replacement materials production capability has been the subject of various studies beginning in 1980. The earliest study, performed under the auspices of the National Security Council in 1980, concluded that at least one new production reactor would be required in the 1990's to assure a reliable supply of defense nuclear materials vital to maintaining stockpile effectiveness. This same basic conclusion has been reached in several follow-on studies and review panel reports on the need for assuring continued reliable nuclear materials production capability.

Since August 1983 the DOE has been conducting studies to evaluate various alternatives. The focus of these studies has been on a New Production Reactor (NPR) with consideration of three principal large reactor concepts (the Heavy Water Reactor, the Special Water Reactor, and the High Temperature Gas-Cooled Reactor) and three candidate sites (the Savannah River Plant, the Hanford site, and the Idaho National Engineering Laboratory). The study areas include safety, environment, status of technology, and costs.

In 1983 the DOE announced that an NPR was needed in the 1990's to assure an uninterrupted supply of tritium and that a reactor concept and site selection recommendation would be developed by 1985 following preparation of an Environmental Impact Statement. However, as a result of our continuing assessments of the options for assuring our capability to fulfill the long-term requirements for producing nuclear materials, a revised strategy is being developed to assure a reliable multi-decade capability for the production of defense nuclear materials. This strategy will be based on a renovation/replacement campaign focused on time-phased, site-unique actions to achieve assured material production well into the next century. It is expected that it will include renovation or replacement of the N Reactor at Hanford on approximately the schedule contemplated for the NPR, the subsequent replacement of a production reactor at the Savannah River Plant, and other initiatives to assure flexibility in meeting future requiremetns for defense materials.

Program activities for FY 1985 and FY 1986 will include: completion of the ongoing studies on large new production reactor concepts; study of other options to assure future availability of defense nuclear materials; development of a reactor production assurance strategy for each site; and planning activities leading to a decision on whether to prepare proposals for each major element of the site strategy including essential National Environment Policy Act activities.

NAVAL REACTORS SUPPORT

The Nuclear Materials Production program budgets for the separative work to produce highly enriched uranium from the Department's gaseous diffusion complex for the Naval Reactors program as shown in Chart 23.

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CHART 23

NAVAL REACTOR SUPPORT

- **PROCURE SEPARATIVE WORK FOR ENRICHING URANIUM FOR NAVAL REACTOR PROGRAM**
- **PROVIDE 3-MONTH WORKING INVENTORY OF SEPARATIVE WORK**

In FY 1986, we will require [deleted] Uranium-235 for the Naval Reactors program. This highly enriched uranium will be used for fabrication of naval propulsion reactor cores. It will also be used to begin naval fuel production in the new facility at Savannah River in FY 1986. This includes process qualification runs and the establishment of work-in-process and finished fuel inventories. Additionally, the FY 1986 request provides for a 3-month working inventory of separative work. This working inventory level will assure an uninterrupted supply of uranium to the Naval Reactors program. The total Naval Reactor support authorization request is $249,200,000.

Summary of FY 1986 Planned Activities

In summary, the major elements of our proposed FY 1986 Nuclear Materials Production budget are directed towards meeting the Nuclear Weapons Stockpile Memorandum requirements and achieving safe, secure, and environmentally acceptable operations of our Nuclear Materials Production complex. A recap of our plans is shown on Chart 24.

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CHART 24

SUMMARY OF PLANNED ACTIVITIES

NUCLEAR MATERIALS PRODUCTION PLANS TO CONTINUE:

- THE BASE PRODUCTION ACTIVITIES ONGOING IN FY 1985
- TO SUPPLY ENRICHED URANIUM FOR NAVAL REACTORS
- SAFETY, SECURITY AND ENVIRONMENTAL IMPROVEMENTS
- RESTORATION PROGRAMS AT FIVE SITES
- THE PRODUCTIVITY RETENTION PROGRAM
- REACTOR SAFETY ON AN ONGOING BASIS
- THE SPECIAL ISOTOPE SEPARATION DEVELOPMENT PROGRAM
- REACTOR PRODUCTION ASSURANCE ACTIVITIES

Defense Waste and Byproducts Management Program

INTRODUCTION

Objective

The Defense Waste and Byproducts Management (DWBM) Program principal objective is to provide essential support for production of nuclear materials and weapons by safe and environmentally responsible management of radioactive wastes. These wastes are primarily of three types—high-level, transuranic, and low-level as described in Chart 25—and are generated primarily by Department of Energy (DOE) defense activities, the nuclear Navy, and other DOE research and development work. The DWBM Program includes the development of technologies and operation of facilities to store, process, or dispose of these wastes. The program also emphasizes providing cost-effective techniques for managing hazardous chemical waste at our defense sites to meet environmental standards.

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CHART 25

RADIOACTIVE WASTE TYPES

HIGH-LEVEL WASTE: WASTE FROM REPROCESSING CHARACTERIZED BY HIGH HEAT AND LONG LASTING HAZARD.

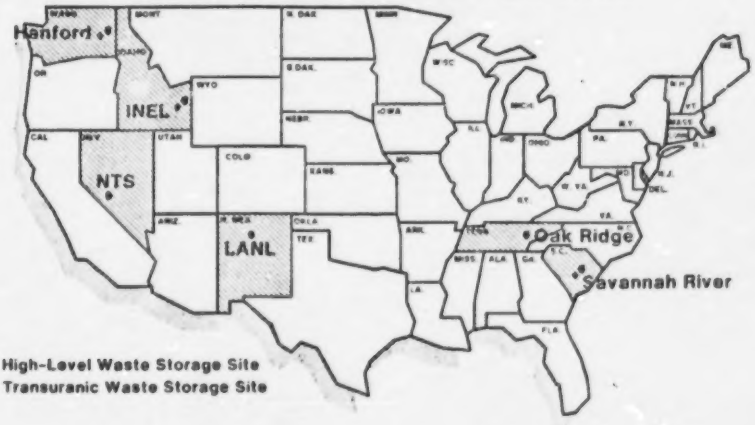
TRANSURANIC WASTE: LOW-LEVEL WASTE CONTAMINATED WITH CERTAIN LONG-LIVED ALPHA ACTIVITY IN EXCESS OF 100 nCi/g.

LOW-LEVEL WASTE: OTHER WASTE CONTAMINATED WITH SHORT-LIVED RADIOACTIVITY. INCLUDES CONTAMINATED EQUIPMENT, COMPONENTS, CLOTHING, TRASH, SLUDGES, ETC.

Our goal is to manage defense wastes routinely, safely, and cost-effectively. This goal includes the disposal of the backlog of stored defense nuclear waste located at the sites shown on Chart 26.

CHART 26

DEFENSE WASTE AND BYPRODUCTS MANAGEMENT HIGH-LEVEL WASTE AND TRANSURANIC WASTE STORAGE SITES



The next chart (Chart 27) shows the volume of waste that has been generated from almost 40 years of nuclear material production activities. Although we are generating increasing quantities of high-level waste (HLW), our inventory by volume—and therefore our need for storage facilities—remains relatively constant due to waste concentration efforts. However, production activities are adding about

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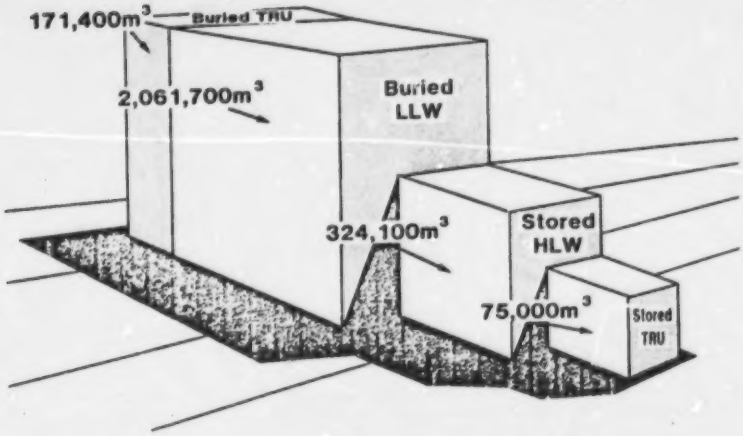
5,500 cubic meters of transuranic (TRU) waste and 90,000 cubic meters of low-level waste (LLW) each year.

CHART 27

DEFENSE WASTE AND BYPRODUCTS MANAGEMENT

Defense Waste Inventory



Our investment strategy is shown in Chart 28. We will continue to manage waste produced and now stored at DOE sites, making the necessary improvements to ensure those operations are conducted safely while pursuing the technologies and processes to prepare waste for final disposal. Our FY 1986 budget request fully supports this strategy. A new DOE order on radioactive waste management has been issued which provides policy and guidelines for managing radioactive waste, waste byproducts, and radioactively contaminated surplus facilities. The order is intended to provide assurance that waste from DOE defense and research and development activities is managed in a safe and environmentally acceptable manner. In addition, at the Idaho National Engineering Laboratory (INEL) and the Hanford site, where we have a security responsibility by virtue of our landlord role, we are making improvements necessary to meet DOE requirements for protection of DOE facilities.

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CHART 28

DEFENSE WASTE PROGRAM INVESTMENT STRATEGY

- OPERATE WASTE FACILITIES SAFELY TO SUPPORT MATERIALS PRODUCTION, WEAPONS FABRICATION, AND NAVAL PROPULSION
- RESTORE WASTE PROCESSING AND STORAGE FACILITIES AND PURSUE SYSTEM IMPROVEMENTS
- PURSUE GEOLOGIC DISPOSAL OF PROPERLY PREPARED WASTES AS A REPLACEMENT FOR INTERIM STORAGE

In June 1983, the President submitted to you the Defense Waste Management Plan which reflected our plans at that time for permanent disposal of HLW and TRU waste. Our FY 1986 program continues to make progress in implementing that Plan. The major portions of that Plan, including construction of: (1) the first immobilization facility for HLW, the Defense Waste Processing Facility (DWPF) at the Savannah River Plant; (2) facilities to process TRU waste at INEL; and (3) the Waste Isolation Pilot Plant (WIPP), have all been supported in prior years and are actually on the down-side of the funding curves for these key facilities. We are beginning to address similar facilities at other sites, ensuring technology transfer and that we are cost-effectively addressing the unique characteristics of defense waste at these sites. Although the schedules for these sites are running somewhat later than the schedules reflected in the Defense Waste Management Plan, we feel it is the proper pace given our technical understanding, the environmental safety of our current storage systems, and our budget priorities. I will talk more about our specific plans in just a moment.

MAJOR PROGRAM ACTIVITIES

High-Level Waste

High-level waste is, in general, the unavoidable, highly radioactive liquid waste byproduct of plutonium production and enriched uranium recovery operations at the Savannah River Plant, INEL, and the Hanford site. Our objective is to end the environmental concern associated with interim storage of HLW in tanks and bins and achieve permanent disposal by immobilizing and preparing HLW for shipment to, and permanent disposal, in a geologic repository. Our schedule for accomplishing this task is shown on Chart 29.

We are right on schedule with construction of the DWPF at the Savannah River Plant. Construction began in October 1983, and hot operations are planned for September 1989. At the Hanford site, we have delayed our schedule about 3 years in order to assure that we have an adequate technical basis for our actions and to reflect budget priorities. A key milestone in our plans for Hanford will be completion of the Environmental Impact Statement which will hopefully allow us to continue with the reference schedule outlined on Chart 29.

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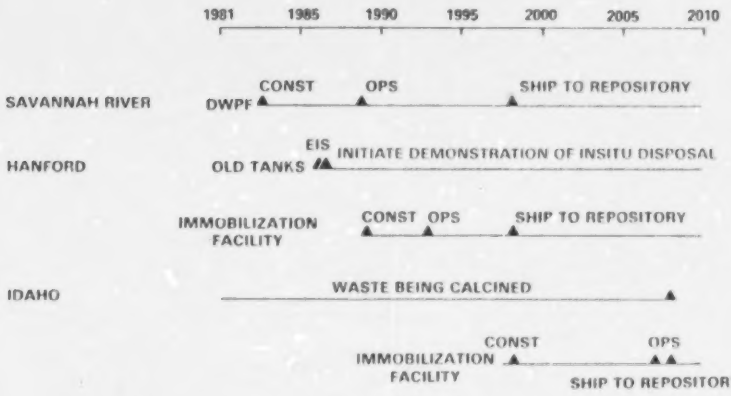
CHART 29

DEFENSE WASTE AND BYPRODUCTS MANAGEMENT

MAJOR MILESTONES FOR PERMANENT DISPOSAL OF DEFENSE HIGH-LEVEL WASTE



As indicated in the chart we hope to dispose of the old single-shell tanks in place, provided the analysis being conducted will support that option. We expect to design an immobilization plant at the Hanford Reservation, building on our experience with the DWPF, and begin construction in FY 1989. In FY 1986 our efforts will focus on planning, process and equipment engineering, and conceptual design to optimize the economics, safety, and reliability of that facility. The INEL continues to store its calcined waste in stainless steel bins. Since waste in this solid form is exceptionally stable, we will continue this approach pending its ultimate disposal from that site in the early part of the twenty-first century.

The Nuclear Waste Policy Act of 1982, Public Law 97-425, directed the President to evaluate, by January 1985, the use of commercial waste disposal capacity for the disposal of defense HLW. That evaluation has shown, taking into account all the factors specified for the evaluation, there is no compelling basis to require disposal of defense HLW in a separate defense repository. Therefore, the Department is proceeding with arrangements to dispose of defense waste in the same repository used for commercial waste. This will include payment to the Nuclear Waste Fund for our defense waste analogous to payment from utilities for their commercial waste. We are beginning negotiations on a payment plan. However, we have not included funding for these payments in our FY 1986 budget.

Transuranic Waste

Transuranic waste contains the long-lived, radioactive elements beyond uranium in the periodic table. The principal element in such waste is plutonium. The objective of the Plan with regard to TRU waste is to end interim storage and begin permanent disposal. Newly generated and stored defense TRU waste will be certified, or processed and certified, for compliance with the WIPP Waste Acceptance Criteria and sent to the WIPP in New Mexico. After a 5 year demonstration period, a decision will be made to leave or retrieve the TRU waste. The demonstration period will focus on those issues for which the State of New Mexico has requested more definition and on development of a more comprehensive understanding of the phenomena involved. Our schedule for shipment of defense TRU waste to WIPP is shown on Chart 30. We are continuing our efforts leading toward waste certification which will begin in late FY 1985 or early FY 1986.

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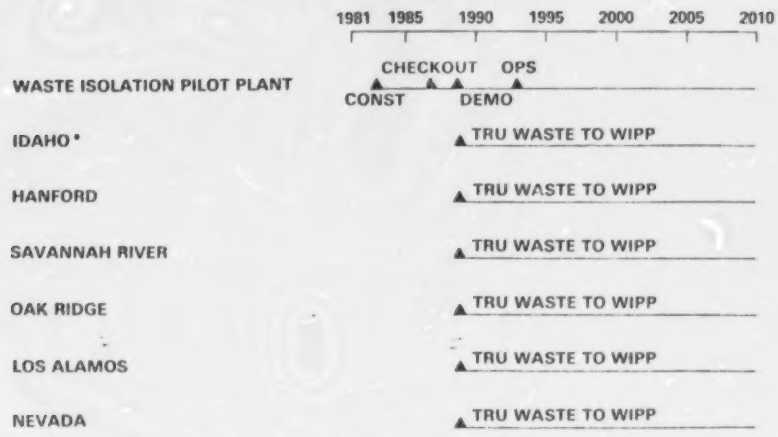
CHART 30

DEFENSE WASTE AND BYPRODUCTS MANAGEMENT

MAJOR MILESTONES FOR PERMANENT DISPOSAL OF DEFENSE TRANSURANIC WASTE



*THE NEPA PROCESS FOR SHIPMENT OF STORED INEL TRANSURANIC WASTE TO THE WIPP HAS BEEN COMPLETED

Our pilot facilities at INEL are continuing on schedule and within cost estimates. The Stored Waste Examination Pilot Plant (SWEPP) facility will begin examining stored waste in FY 1986, and the Processing Experimental Pilot Plant (PREPP) facility will begin processing waste, as necessary, in FY 1987. The construction of the WIPP is proceeding extremely well, and we now expect to complete this facility by December 1986. Construction of facilities to process stored transuranic waste at the Savannah River Plant and the Hanford site are 2-3 years behind those shown in the Plan. These have been delayed because of our need to ensure a thorough technology transfer, enabling us to build the most cost-effective facilities, and in no way represents a lack of commitment to address the transuranic waste stored at these sites.

Costs

I would now like to address FY 1986 funding needs as shown on Chart 31.

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CHART 31

DEFENSE WASTE AND BYPRODUCTS MANAGEMENT
FY 1986 BUDGET REQUEST
($ IN MILLIONS)

	FY 1985		FY 1986	
	AUTH.	APPROP.	AUTH.	APPROP.
INTERIM WASTE OPERATIONS	$314.8	$324.5	$377.2	$379.4
LONG-TERM WASTE MANAGEMENT TECHNOLOGY (DEFENSE WASTE PROCESSING FACILITY)	326.7 (256.1)	326.7 (256.1)	307.8 (236.5)	307.8 (236.5)
TERMINAL STORAGE (WIPP)	77.5	77.5	25.4	25.4
PROGRAM DIRECTION	1.9	1.9	2.4	2.4
TOTAL	$720.9	$730.6	$712.8	$715.0

A summary of the reasons for our budget changes is shown in Chart 32. While we are beginning to reduce our overall construction requests for the DWPF and the WIPP, our operating expenses are increasing because we are adding a new dimension to our program—processing waste for eventual disposal.

CHART 32

DEFENSE WASTE AND BYPRODUCTS MANAGEMENT
INCREASES OVER FY 1985
(DOLLARS IN MILLIONS)

FY 1985 AUTHORIZATION	$720.9
• ESCALATION	+ 20.7
• FIRST YEAR OPERATION OF TRU FACILITIES (IDAHO)	+ 9.3
• TREAT NEW PUREX WASTE AND SUPPORT DESIGN OF HLW IMMOBILIZATION FACILITY (HANFORD)	+ 12.6
• ACCELERATE SALT REMOVAL/PROCESSING TO ASSURE ADEQUATE TANK SPACE AND PROVIDE FEED FOR SALTSTONE FACILITY (SAVANNAH RIVER)	+ 6.2
• PROVIDE CONSTRUCTION TO ASSURE "CONTINUED OPERATIONS"	+ 13.4
• PROVIDE HAZARDOUS CHEMICAL WASTE TECHNICAL SUPPORT	+ 1.8
• MAINTAIN WIPP AND DWPF SCHEDULES	74.4
• OTHER SITE IMPROVEMENTS	+ 2.3
FY 1986 REQUEST	$712.8

I will now describe our FY 1986 program in more detail.

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Interim Waste Operations

The principal objective of this program is the safe and environmentally acceptable management of existing and newly-generated waste from nuclear materials and weapons production and naval reactors operations, pending implementation of permanent disposal operations. The program includes the operation and maintenance of HLW storage tanks, bins, and related processing and storage facilities at Hanford, the Savannah River Plant, and INEL; the operation and maintenance of LLW burial grounds at the Savannah River Plant, Oak Ridge National Laboratory (ORNL), Idaho National Engineering Laboratory, Hanford Reservation, Los Alamos National Laboratory, Sandia National Laboratory, and Nevada Test Site; the retrievable storage of transuranic waste at various sites; the operation of low-level liquid waste facilities; the operation of three filter test stations; and the processing of low-level gaseous effluents.

During fiscal years 1985 and 1986, the transfer of HLW from old tanks to new tanks will continue at the Hanford site. This program was curtailed in FY 1985 due to storage limitations in the new HLW tanks. Increased funding is required in 1986 to support continuation of the stabilization and isolation of old single-shell HLW tanks. An additional 10 tanks will be isolated from the environment in FY 1985 and 9 in FY 1986 for a total of 83 out of 149. This program will be completed in FY 1989 as scheduled. Also at Hanford, the solidification and encapsulation of an additional 161 strontium capsules from HLW was completed in the B-Plant facility in FY 1984, and we expect to complete encapsulation of the remaining strontium by the second quarter of FY 1985 (a total of 630–660 capsules planned) for safer storage and potential beneficial use. Encapsulation of the entire backlog of cesium (1,575 capsules) was completed in FY 1983.

A major effort at Hanford in fiscal years 1985 and 1986, after the strontium campaign is completed, will be to convert the B-Plant facility for processing liquid TRU and HLW from PUREX operations. Studies over the last year have identified the benefit of using B-Plant for treating newly generated waste from PUREX. When fully operational, processing of PUREX waste streams in B-Plant will save significant costs in two ways. First, by segregating the low-level component from the waste, HLW tank farm storage space will be saved. Second, the volume of waste which will ultimately have to be vitrified for disposal will be significantly reduced. Vitrification of as much as 40 million gallons of waste can be avoided, with a resultant savings in excess of $1.0 billion. Initial processing demonstrations on liquid TRU waste will be complete by the end of FY 1986.

Also at Hanford, construction of the eight double-shell tanks begun in 1983 to provide storage space for PUREX waste is 6 months ahead of schedule. Construction will be completed in the second quarter of FY 1986, assuring that adequate storage space is available for PUREX waste. Construction of a portable grout facility to solidify low-level liquid waste for shallow land disposal, as part of the Waste Handling and Isolation Facilities Project, is continuing. Operations will begin in FY 1986.

The Savannah River Plant waste transfer program is scheduled for completion in 1994. Waste transfer from single-shell tanks has been accelerated and will now be completed in FY 1986. An optimum schedule interface will be maintained between waste preparation in the tank farm and feed requirements for the DWPF. In order to assure an adequate backlog of feed for DWPF operation, sludge washing facilities will begin operation in 1986. Installation of salt decontamination facilities will continue in 1986, and operation will begin in 1987. This activity will save a significant volume of tank space. Design and construction of a New Waste Transfer Facility to replace old inadequate facilities and to interface with the DWPF will continue in FY 1986.

At Oak Ridge, there is a priority need for a new LLW disposal facility. Several factors create this priority need: (1) curtailment of the use of existing disposal facilities at Y-12 for environmental reasons; (2) the need to process and dispose of immobilized radioactive sludge resulting from liquid process waste generated at Y-12 and the Oak Ridge Gaseous Diffusion Plant; and (3) the near-term exhaustion of the disposal capacity at ORNL. Efforts to design and develop a new LLW disposal facility are continuing. A preferred site has been selected and studies are underway to identify additional measures to assure the environmental acceptability of disposal operations. Evaluation of alternatives for facility design and waste treatment will continue in FY 1985. As part of a major review of waste disposal practices at the Oak Ridge complex, a revised Environmental Impact Statement for the disposal facility will be issued in early FY 1986.

Funding is requested for detailed design of the preferred alternative in FY 1986, which will permit facility operation possibly by late FY 1988. As shown in Chart 33, [chart deleted] the New Hydrofracture Facility at the ORNL has been in operation

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since 1981, and disposal of the backlog of gunite tank waste was completed in early 1984. In August 1984, unexpected elevated levels of radioactivity were discovered in a deep monitoring well located within approximately 1,000 feet of the injection well. Oak Ridge is currently gathering and analyzing additional data from the well. No health or safety hazard exists, and the National Academy of Sciences is participating as an independent reviewer of the data. Grout injections at the New Hydrofracture Facility have been suspended pending completion of studies to determine the cause of the elevated radioactivity levels, to assess the significance of any environmental impacts, and to determine if any corrective actions are required.

The DWBM program assumed responsibility for the management of low-level radioactive waste at the Feed Materials Production Center (FMPC), Fernald, Ohio, in FY 1985. Waste generation is expanding rapidly with increased production efforts at that facility. To handle the increase, a decision has been made to process, package, and transport all LLW for disposal at another DOE facility. As opposed to processing and storage in silos on site, this promises to save the taxpayer about $20,000,000 over the next twenty years. Some of the waste, which can be shipped with minimal processing, will be shipped in FY 1985. For FY 1986 we have proposed construction of a facility which will process the rest of the waste so it can also be shipped. The facility will be operational in 1989. Until that time, waste will be stored on site in drums. In the outyears, we will also be evaluating options for the disposal of waste previously stored in pits and silos since the early 1950's.

In FY 1986 at INEL, the SWEPP will begin the first full year of operation. The SWEPP will examine and certify stored waste containers for the WIPP. The PREPP will process stored waste containers that do not meet the WIPP criteria. The PREPP will begin cold check-out in FY 1986 and begin hot operation in FY 1987.

Waste Volume Reduction

Waste volume reduction is an important element of the Interim Waste Operations Program because it extends the lifetime of storage and disposal facilities and delays the need for new facilities. At the Savannah River Plant, for example, our goal for fiscal year 1985 and 1986 is to annually gain 6 million gallons of HLW storage through our evaporation processes. This is the volume equivalent of about six new tanks. At Hanford, evaporator operations continue to support PUREX reprocessing operations and reduce tank requirements.

Solid waste volume reduction operations will continue in order to reduce the rate of expansion of new burial ground facilities at our sites. Segregation and examination of TRU waste will reduce the amount which must be stored, certified, and eventually transported to and emplaced in the WIPP.

Funds invested in development and demonstration of volume reduction and waste segregation techniques will result in decreased requirements for disposal and storage facilities and their related operating, closure, and long-term maintenance and surveillance costs. We will continue to study improved volume reduction technology to enhance both transportation and disposal.

During FY 1986 we will continue to dispose of LLW and to retrievably store TRU waste. We are continuing to develop procedures to assure that newly generated TRU waste will be acceptable for emplacement in the WIPP. This certifiable waste will be stored separately.

At the INEL, the New Waste Calcining Facility (NWCF) (Chart 34) began operations in September 1982. This facility converts liquid HLW into a granular solid, called "calcine," for interim storage in bins. The NWCF is a critical element of the fuel processing operation at INEL, since there is no excess capacity for lag storage of liquid HLW. Since startup, this facility has calcined more than one million gallons of liquid. In fact, the NWCF has consistently operated at greater than design basis, sometimes as much as 50 percent greater than anticipated. The construction of the sixth set of storage bins for calcine will continue at INEL with a scheduled completion in September 1985. Construction of the seventh set of bins will begin in March 1985 and be completed in June 1989, assuring that sufficient waste storage capacity is available to support production activities.

At Oak Ridge, we will complete a program to size reduce and sort approximately 40,000 tons of contaminated scrap metal and trash in FY 1986, thus minimizing a potential environmental problem. The waste will be disposed of and the volume of scrap will have been significantly reduced. The scrap will be stored for potential recycle.

Landlord Responsibilities

Under our landlord responsibilties, we will continue restoration of badly deteriorated general purpose support facilities and equipment to an acceptable standard of

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safety, reliability, and efficiency. Our goal is to complete the facilities restoration part of our landlord responsibilities at the Hanford site in FY 1987. The FY 1986 Hanford Landlord Program continues the design and construction of a new central warehouse facility to replace the old one which is beyond economical repair.

Landlord responsibilities at INEL were assumed in FY 1983. Maintenance, repair, and replacement activities continue for general purpose site support facilities such as security installations, utilities, roads, and service buildings. Also, the landlord program continues to maintain site fire and safety alarm systems. A major enhancement of site security systems and facilities is underway. In FY 1984 the number of site security personnel was increased from about 100 to 300. The INEL Security Upgrade Project to provide accommodations for security personnel and equipment, to harden facilities, and to improve site access control will start in FY 1986. Construction of the Test Reactor Area Security System Upgrade to meet requirements for detection and prevention of intrusion was started in FY 1985 and will continue in FY 1986.

Decontamination and Decommissioning

We are responsible for about 200 contaminated surplus defense facilities, including reactors, reprocessing plants, and waste management facilities. The facilities have been stabilized and are routinely monitored and maintained. Our program emphasizes the safe management of these facilities, stressing beneficial reuse of structures, reduction of future maintenance costs, and recovery of valuable materials where cost effective. For FY 1985 we will continue to monitor and maintain all surplus defense facilities and continue high priority decommissioning work at INEL, the Mound Facility, the ORNL, and the Hanford site with particular emphasis on facility reuse and cost effectiveness. In FY 1986, we plan to complete the NEPA process and begin decommissioning the surplus production reactors at Hanford. The preferred alternative is in-place stabilization of the reactors and entombment with soil. Chart 35 [chart deleted] is a photograph of the 105-F reactor, which will be the first of eight reactors to be decommissioned. In FY 1986, we also plan to conduct characterization studies of the Grand Junction Treasure Island Site uranium ore residues, which were generated in support of Defense Program activities and are a source of groundwater contamination.

Transportation Operations

We are also responsible for the Department-wide transportation management program to assure the safe, secure, environmentally acceptable, efficient, and economic shipment of DOE materials in compliance with applicable Federal and State laws and regulations. This responsibility includes operational aspects of materials transportation, radioactive materials packaging operations and certification, and classification of explosives for transportation in support of all Departmental programs.

Major activities in FY 1985 include continued improvements on data automation for more efficient utilization and management of resources; continued negotiations toward reduced or volume discount rates on DOE and DOE contractor shipments; continuation of training and workshops for personnel involved in DOE shipment of hazardous materials; and development of a certification program for traffic managers.

In FY 1986, the Transportation Management Program will continue to support its data automation and training programs, as well as activities necessary to ensure the most economic shipping rates. Criteria for Hazardous Materials Packaging Quality Assurance will be developed to assure all packages meet requirements and are properly maintained. A Safety Analysis Report for Packaging (SARP) Evaluation Guide will be prepared to establish uniformity among all field offices for the evaluation of SARP's.

A Department-wide shipment plan for hazardous materials, chemicals, and wastes will be developed in FY 1986, and evaluations will be performed to assure the DOE complies fully with all applicable regulations and requirements. Compliance training programs will be modified as necessary to accommodate any deficiencies noted in the evaluations. In addition, a program will be funded in FY 1986 to develop a more comprehensive management information and outreach program with State and local governments, Indian tribes, and other entities that have expressed concerns regarding DOE radioactive materials shipments through their jurisdictions.

Long-Term Waste Management Technology

This program addresses the long-term management and disposal of defense wastes. The program is consistent with policies set forth in the Defense Waste Management Plan for permanent disposal of defense HLW and TRU waste. The Long-

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Term Waste Management Technology Program has been expanded to include hazardous chemical defense waste management technology to respond to the increased attention at DOE sites in managing such waste in compliance with appropriate EPA regulations.

High-Level Waste Technology

As I mentioned earlier, we are developing the technology for the long-term management of defense HLW at DOE sites. Our first emphasis is on the DWPF at the Savannah River Plant and second is the Hanford Waste Vitrification Plant (HWVP) at the Hanford site. During FY 1986 we will continue large-scale tests with simulated waste to optimize the design and demonstrate the reliability of the DWPF systems, including slurry feed, off-gas, salt disposal, and process controls. Smaller scale tests with actual HLW from the Savannah River Plant will continue in hot cells. Together, these tests will ensure that the DWPF will work as designed. We will continue to describe and document the predicted behavior of the glass waste form in a geologic repository and make confirmatory tests. During FY 1986 emphasis will shift toward planning, development, selection, and implementation of the long-term technology for HLW at Hanford. Efforts will focus on the preconceptual design of the HWVP, which will provide the same service as the DWPF.

Defense Waste Processing Facility

(Chart 36 deleted.)

The DWPF will immobilize defense HLW at the Savannah River Plant for storage, transportation, and disposal in a geologic repository. The sludge fraction of the HLW, which contains most of the hazardous radionuclides and virtually all of the long-lived activity, will be immobilized directly in borosilicate glass after extracting mercury. The activity in the soluble salt fraction of the waste, primarily radioactive cesium, will be separated by precipitation in the tank farm. Cesium can possibly be used as a beneficial byproduct, in an appropriate form. The decontaminated salt will be solidified and disposed of on the Savannah River site beginning in FY 1987, to free-up storage tank space. When the DWPF is operational in FY 1989, we will begin to work off the backlog of HLW from production operations at the Savannah River Plant, reaching a steady-state operation in about 15 years.

(Chart 37 deleted.)

Construction of the DWPF began ahead of schedule in October 1983. By the end of FY 1986, design will be more than 90 percent complete and construction of the main process building and support facilities will be about 45 percent complete. Construction activity will peak in FY 1986, with over 2,000 construction workers on site. We are requesting $205 million for the project in FY 1986, a $25.5 million decrease from FY 1985. Although less than the approved baseline, the requested funding will maintain scheduled project completion in June 1989 and the current total estimated cost of $870 million. Operation of facilities to solidify decontaminated salt solution for disposal as low-level waste will begin in FY 1987.

It is very important that our construction schedule be maintained. We have planned this project to be cost effective consistent with the Grace Commission's recommendations. Any delays will not only increase costs, but will also cause significant operational problems at the Savannah River Plant. We are running out of tank space in which to store HLW, and we must continue to remove waste from the old tanks before problems develop. Major delays in the DWPF project could require building additional tanks and make the HLW cleanup job greater and more expensive.

The cost estimate for this project has been reduced by about 70 percent from the original FY 1979 capital cost estimate of $2.8 billion through research and development and design optimization. We will continue to pursue opportunities to reduce its cost further through effective project management by DOE staff and contractors during the construction phase.

Hanford Waste Vitrification Plant

Since the mid 1940's nuclear fuel has been irradiated and reprocessed at the Hanford site to produce nuclear materials for national defense programs. The liquid radioactive waste from fuel reprocessing has been neutralized and stored in large underground steel tanks on an interim basis pending decisions on the timing and methods for permanent disposal.

The HWVP will convert Hanford HLW to a glass form for permanent disposal. It serves the same function and is based on the same process technology as the DWPF now under construction at the Savannah River Plant. While some refinements and

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testing are needed, the basic technology for vitrification of Hanford HLW is in hand and facility design and construction can be undertaken with confidence.

Design support and engineering R&D will continue in FY 1986 for an immobilization facility to prepare Hanford HLW for disposal. Existing technology and design data from the DWPF will be used to the maximum extent practical to reduce cost and duplication of effort. Basic process requirements are similar to the DWPF except that an existing waste preparation facility at Hanford, B-Plant, will be used instead of in-tank processing. The decontaminated salt fraction will be immobilized and disposed as LLW. Preconceptual design of the HWVP will continue in FY 1986 with the addition of the architect/engineer to the project.

Transuranic Waste Technology

The primary purpose of the TRU Technology Program is to support the WIPP. The first priority is to routinely certify newly generated waste and to commence retrieval, certification, and processing of stored waste. This ensures a backlog of waste for the successful disposal demonstration in the WIPP.

At INEL, we completed the designs for two pilot plants in FY 1983—the SWEPP to examine and certify stored waste containers for the WIPP, and the PREPP to demonstrate processes for treating stored waste containers as shown in Chart 38 [chart deleted] that do not meet the WIPP criteria. In FY 1984 we completed construction of the SWEPP. In FY 1985 checkout and startup will be completed with experimental operations beginning in FY 1986. Construction of the PREPP will continue in FY 1985 with startup and checkout in FY 1986.

Other FY 1986 activities include: (1) completion of final waste inventory plans at each storage site; (2) demonstration of the mobile non-destructive assay instrumentation to certify waste; (3) demonstration of a waste transport system; (4) testing of an on-site buried waste stabilization process, in-situ vitrification; (5) continuation of NEPA documentation to retrieve, certify and transport waste to the WIPP from all sites other than INEL and generating sites shipping to INEL; and (6) continuation of technology development for reduced waste generation.

Low-Level Waste Technology

The Low-Level Waste Technology Program supports DOE waste operations for the disposal of low-level solid wastes. The objectives of this generic technology program are to: improve techniques for disposal by shallow land burial including methods for accurate prediction through adequate monitoring and modeling; provide supporting documentation in assuring compliance with DOE criteria for disposal by shallow land burial; develop cost effective treatment processes to stabilize certain LLW streams and reduce volumes by generation avoidance; and evaluate disposal concepts such as greater confinement. In FY 1986 funding will provide for integrated field testing for shallow land burial improvements, testing to research waste source transport mechanisms, and limited development for shallow land burial corrective measures and treatment processes.

Hazardous Chemical Defense Waste Management

The Hazardous Chemical Defense Waste Management program supports DOE site operations for the treatment, storage, and disposal of nazardous wastes generated by Defense Program activities. This program will be supportive of hazardous waste efforts required to cost-effectively comply with EPA regulations in implementation of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA). The objectives of this generic technology application program are to provide for development or identification and application of existing techniques in processing hazardous waste from currently generated Defense Program waste streams and environmental restoration of inactive Defense Program hazardous waste sites. Program elements consist of waste generation reduction, waste treatment, chemical recycle utilization, disposal alternatives, monitoring and modeling, probabilistic risk assessment, and environmental restoration. In FY 1986 funding will provide for development of hazardous waste inventory and technology data bases, and application of technology emphasizing treatment processes which will bring waste streams into compliance with hazardous waste regulation considerations.

Transportation Research and Development

This program seeks to assure that safe, efficient, and reliable transportation equipment and systems will be available for defense nuclear wastes. Packaging development, packaging technology development, testing risk analyses, and other re-

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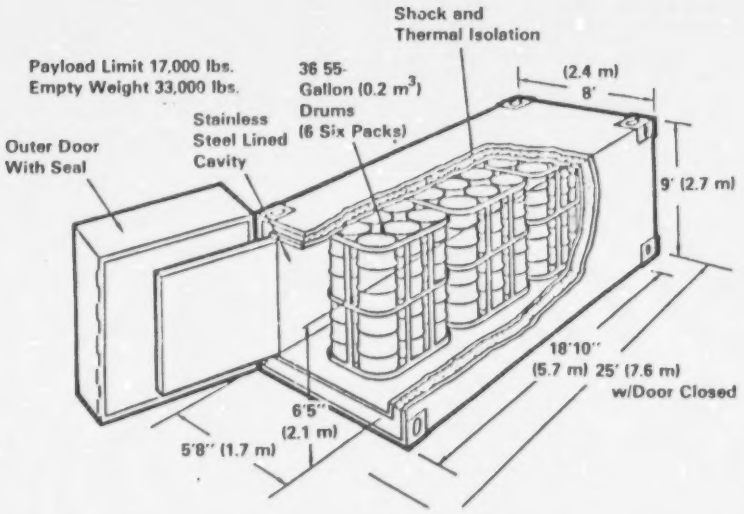
lated activities are conducted at the DOE Transportation Technology Center at Sandia National Laboratories at Albuquerque, New Mexico.

In FY 1985, work will continue on the development of the TRUPACT packaging intended primarily for transporting contact-handled TRU waste; the defense HLW cask and its adaptation to remote-handled TRU waste; and the Beneficial Uses Shipping Systems (BUSS) cask. Hypothetical accident condition tests were conducted on a prototype TRUPACT during the summer of 1984. Results from the dynamic tests were as anticipated, deformations were as predicted, and measured seal leak rates were within the allowable range. Excessive seal temperatures were reached during fire testing, causing the packaging seals to exceed allowable leak rates during conditions of an extended hypothetical accident. Design modifications will be required to limit the inner door seal temperatures and assure acceptable leak rates are maintained. Work will continue in a base technology program which has DOE-wide applicability for all DOE nuclear program transportation needs. The base technology program includes packaging design development, materials investigations, standards development, testing, test facilities development, operational safety and risk analyses, Environmental Impact Statement preparation, logistics and economic analyses, regulatory issues analyses, and data base development.

CHART 37

TRUPACT (TRUCK VERSION) PRELIMINARY DESIGN



The first TRUPACT unit will be operational in FY 1985, and a demonstration period will begin. In FY 1986, the operational demonstration of TRUPACT will be completed, and fleet unit fabrication will commence. Value engineering and second generation modifications will be pursued for improved efficiency and decreased unit cost. The defense HLW cask half-scale model will be fabricated and tested for regulatory compliance, and development will be completed during FY 1986. It will be used to transport HLW glass logs from DWPF to a repository and will be adapted for use in transporting remote-handled TRU waste to WIPP. Improved data base access will also be examined and improvements instituted.

The defense HLW cask prototype fabrication will commence and the BUSS cask stainless steel unit will be operational during FY 1986. A remote-handled TRU waste cask program that will permit a limited number of remote-handled TRU shipments in late FY 1987 will be firmly established. The base technology portion of the program will be integrated with the Transportation R&D activities conducted by the DOE Office of Civilian Radioactive Waste Management.

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Terminal Storage—Waste Isolation Pilot Plant

The WIPP, now under development near Carlsbad, New Mexico, will provide a research and development facility to demonstrate the safe disposal of radioactive waste from national defense programs. The WIPP is authorized by Public Law 96-164 and is exempt from licensing by the Nuclear Regulatory Commission.

The primary objectives of WIPP are to demonstrate, through a full-scale pilot plant, the technical and operational methods for permanent isolation of defense-generated TRU radioactive waste and to provide a facility for experiments on HLW in bedded salt. The facility is designed to receive, inspect, emplace, and store defense waste. It will have the capability of disposing of defense TRU waste and conducting experiments with defense-generated HLW. The experiments with HLW will be coordinated with the Office of Civilian Radioactive Waste Management consistent with the procedural agreement executed October 22, 1984.

The construction of permanent surface and underground facilities started in July 1983, following an extensive exploratory program. This exploratory program included two large diameter shafts and mining over 2 miles of drifts (tunnels) to confirm the subsurface geology. Construction completion is scheduled for December 1986. A test and checkout period will follow, with waste receiving operations targeted for October 1988.

Much construction progress has been made during FY 1984 and FY 1985. Enlargement of the 6 foot diameter exploratory shaft to its final 19 foot diameter has been completed. The third shaft for facility ventilation has also been completed. Major contracts for constructing access roads, a rail spur, and a 31 mile water pipeline are completed. Mining for the underground experimental areas will be completed in March 1985. The main waste handling building was started in mid-1984.

With site characterization and site validation complete, Sandia research and development activities will emphasize in-situ experiments. These experiments and demonstrations will establish the technical basis for defense waste disposal in bedded salt. This work will be based on an extensive background of predictive model development and laboratory/field testing. Specific technology experiments will include thermal/structural interaction, operations demonstration, and waste package performance. The experiments will be conducted in areas mined during the exploratory program.

Emergency response training and an emergency response exercise have been held. Such activities will continue. A Quality Assurance Audit will be held in the spring to ensure safety and efficiency during disposal operations and concurrent mining operations.

Good relations with the State of New Mexico are important in continuing construction of WIPP. Issues of concern to the State are being actively negotiated within the framework of the Consultation and Cooperation Agreement.

One primary State concern is the mission of WIPP. Our mission is limited to the demonstration of TRU waste disposal and experiments with defense HLW. As stated earlier, we will coordinate our HLW experiments with the Office of Civilian Radioactive Waste Management and are committed to removing the HLW upon completion of the experiments or decommissioning of the facility. This mission is consistent with Public Law 96-164, its Conference Report (House Report 96-702), and subsequent budget authorization legislation. We want to reemphasize that the WIPP facility is not being designed for the permanent disposal of HLW, nor has the site been characterized for such permanent disposal. Our site characterization program was directed toward the statutory mission of demonstration of disposal of TRU waste and the HLW experiments.

In February 1984, the Secretary directed that negotiations with the State of New Mexico continue so that a timely agreement could be reached which defines the WIPP mission within the bounds described above. That agreement was completed in November 1984, and copies have been sent to the appropriate committees of Congress for their information.

The Administration is supporting the WIPP Project with a request for $25.1 million. Fiscal year 1986 will be a peak year of construction at the WIPP site. Site utilities, the exhaust filter building, and the TRUPACT maintenance facility will be completed. Also, the primary waste handling building, started in FY 1984, will be completed in FY 1986. Assuming project activities continue successfully, as they have in the past, WIPP will be ready to receive radioactive waste on schedule in October 1988.

Byproducts and Beneficial Use

The objective of the Byproducts and Beneficial Use Program is to identify and develop safe, environmentally acceptable, beneficial, and cost-effective applications of

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radioisotopes and materials from the defense fuel cycle. Also included is the development of power, light, heat, and electrical sources for our national defense needs that are long-lived, reliable, and secure. With the recent reprogramming request, which has been sent to the Congress in response to FY 1985 congressional guidance, we expect to provide 1 year of operational demonstration for each of the three irradiators which will be nearing construction completion in late FY 1985. With regard to prototype power generators using the defense waste byproduct, strontium-90, fabrication of a high power 500 watt radioisotope thermoelectric generator (RTG) will be completed in FY 1985. In FY 1986 the RTG will be fueled and turned over to the Department of Defense for demonstration, such as in the emergency shelter of the unmanned short-range radar station of the North Warning System. In FY 1985 tritium radioluminescent airfield landing lights will be used by the U.S. Air Force at Spangdahlem Air Force Base, Germany, and tested and evaluated with other newly developed equipment for Rapid Runway Repair in Operation Salty-85 Demo.

This completes my presentation. I shall be happy to answer any questions you may have on either the Nuclear Materials Production Program or the Defense Waste and Byproducts Management Program.

PREPARED STATEMENT OF BILLY G. COOK, DEPUTY ASSISTANT SECRETARY FOR SECURITY AFFAIRS, DEPARTMENT OF ENERGY

SECURITY AFFAIRS ACTIVITIES

Mr. Chairman and members of the Committee, I am Billy G. Cook, Deputy Assistant Secretary for Security Affairs. It is a pleasure to appear before you today to address the Department of Energy's Security Affairs programs of Nuclear Safeguards and Security (including Classification), Security Investigations, and Verification and Control Technology and our FY 1986 budget request required to carry out these important programs.

This is my first opportunity to testify before this committee. Before proceeding with the discussion of the budget request, permit me to introduce myself to you in a little detail. I was appointed Deputy Assistant Secretary for Security Affairs on January 8, 1985. Prior to assuming this position, I served for more than 27 years in the United States Army, retiring on October 31, 1984, as a Colonel. My military career was primarily in the nuclear and chemical areas. During the last few years I have been extensively involved in nuclear security and survivability issues and the management of a complex program for upgrading the security of the United States nuclear weapons sites in the North Atlantic Treaty Organization (NATO). Subsequently, as the Special Assistant for Nuclear Security and Survivability in the Office of the Secretary of Defense, I was responsible for developing and overseeing these areas both within and outside the continental United States. These duties required extensive interface and management with all major agencies and NATO. These experiences have, I believe, prepared me well for my current assignment. I have attached my biography to this statement.

Mr. Chairman, it is my intention to keep you fully and currently informed on all activities of interest to your Committee in the Security Affairs area. Routinely, I will be communicating our program initiatives and areas of concern to you. If you or your Committee seek additional information on our programs, I would be pleased to meet with you.

SECURITY AFFAIRS

The programs under my purview in Security Affairs that I would like to discuss with you today play an extremely critical role in fulfilling the Department's national security mission, and we are keenly aware of the importance of our responsibilities in carrying out these activities. These programs are the Department's cornerstone in: preventing the theft or sabotage of nuclear weapons, materials, facilities, and classified information; developing and implementing policy for managing the classification and declassification of information; providing nuclear weapons systems expertise to the Intelligence Community; controlling proposed exports of nuclear materials and equipment; providing technology and equipment necessary to monitor treaty compliance of foreign nuclear weapons programs; and providing technical and analytical support for DOE's role in arms control negotiations, policy formulation, and implementation.

Here with me today are Mr. Robert A. O'Brien, Director, Office of Safeguards and Security; Dr. Julio L. Torres, Director, Office of International Security Affairs; and Mrs. Jill E. Lytle, Director, Office of Classification. All three individuals would be

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pleased to answer any questions you or the members of the Committee might have. Also here with us today is Mr. Charles Boykin, the Deputy Assistant Secretary for Intelligence. Funding for the intelligence activities, which are organizationally assigned to Mr. Boykin, is included within the Verification and Control Technology request and, accordingly, I will cover intelligence matters in my presentation today. Mr. Boykin will be happy to answer any questions you may have regarding DOE intelligence activities.

With the Chairman's permission, I will submit my formal statement for the record. I would then like to make a presentation which covers the Security Affairs program activities, highlights some of our recent accomplishments, particularly in the safeguards and security area, and discusses the funding requested in the President's Fiscal Year 1986 budget. You each have copies of my formal statement and the viewgraphs I will use today.

FISCAL YEAR 1986 BUDGET

The overall funding requirement in Fiscal Year 1986 for Security Affairs' programs is $186.9 million. This consists of $59.9 million for Nuclear Safeguards and Security (including $3.8 million for Classification), $33.4 million for Security Investigations, and $93.6 million for Verification and Control Technology. I will now briefly discuss each of the Security Affairs programs.

NUCLEAR SAFEGUARDS AND SECURITY

The Nuclear Safeguards and Security program has three major program goals. These are:

To prevent the theft, sabotage, or loss of nuclear materials, facilities, and unauthorized disclosure of classified information;

To provide a base of safeguards and security technology and information which can be used to protect Department of Energy facilities, and to control and account for nuclear weapons, materials, and classified information; and

To strengthen international safeguards and physical security to deter the diversion of nuclear materials and support nonproliferation and national security objectives.

In the short time since I have been associated with the Department of Energy, I have visited most of the DOE facilities of major security concern. I have toured our most critical sites and reviewed the vulnerabilities that currently exist and the upgrades and actions that have been taken or are underway to mitigate these vulnerabilities. Also, I have seen our special response teams in tactical training exercises. The confidence of the people I have talked with, and the improvements already made, underway, and planned, convince me that the Department has turned the corner in improving the posture of our safeguards and security program. However, vulnerabilities still remain which will not be mitigated until some long-term construction projects are completed and a unique site-by-site safeguards and security management program is accomplished. This is now underway and will result in better overall security, awareness, and commitment than previously experienced. Of particular significance is the potential for greatly improving cost effectiveness concurrently with security.

During my visits to our critical facilities, it was quite clear that greater emphasis needs to be directed to materials control and accountability of special nuclear materials (SNM). I am committed to ensuring that all critical SNM process flows are reviewed with the objective of implementing and monitoring state-of-the-art measurements, techniques, and procedures for nuclear material accountability. Also, I am vigorously pursuing the concept of error of propagation statistical methods at our facilities that process SNM in order to ensure we have high confidence associated with site Inventory Differences (ID's). With respect to ID's, we are conducting research and development in the areas of process flow holdup and instruments that are designed to characterize hard-to-measure materials such as uranium in dissolver solutions and gas phases. Other research and development is directed toward concepts for integrating and automating systems of measurement instrumentation to enhance overall performance and cost-effectiveness of the total system.

Additionally, I am keenly aware that the advent of the personal computer explosion requires us to revisit our requirements and potential vulnerabilities at our facilities that process classified information on computers. As a result of my meetings with computer specialists at the facilities I have recently visited, it is my strong opinion that greater awareness, additional resources in the DOE sector, more stringent processing requirements, and system vulnerability assessments are required in the computer security area. I have instructed our Computer Security Center of Ex-

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cellence, Los Alamos National Laboratory, to closely examine this concern and identify research and development requirements in this most important area. I am significantly expanding the size of the computer security effort in Security Affairs. This is one of the key programs which I will be developing and monitoring very closely this year.

Our improved Safeguards and Security posture is due in large measure to DOE's top management personally supporting and making this program one of its main priorities over the last few years. This same support has also been exhibited by this Committee and the Office of Management and Budget. Mr. Chairman, as we are still in the enhancement mode, in that there is still much to be done, we again require your support to enable the Department to further improve and integrate a comprehensive safeguards and security program.

INITIATIVES

Before discussing in detail the specific program areas for which funding is requested, I would like to call your attention to a number of initiatives which we have undertaken to enhance our overall operations.

The Federal Aviation Administration (FAA), as requested by DOE, has completed a series of public hearings on airspace restrictions over nine critical DOE facilities. We anticipate that the FAA will issue a proposed rulemaking on the restrictions for several sites about mid calendar year 1985, with the remaining sites to follow as specific implementation problems are resolved.

A DOE Central Training Academy has been established at Kirtland AFB, New Mexico, and is beginning operations. Its purpose is to effect a uniform approach to training in tactical, legal, operational, and technical aspects of physical security.

Public hearings were held and a final rule was published on physical fitness and medical standards for DOE protective force personnel. The standards became effective in December 1984.

A proposed rule was developed and public hearings held on arrest authority and use of deadly force by DOE protective force personnel. A final rule is anticipated in 1985.

DOE protected areas have been upgraded by providing improved perimeter barriers and lighting; new or improved patrol stations and towers; new or improved security operations support facilities; installation of key card access control systems; computer controlled alarm and closed-circuit television (CCTV) surveillance systems; electronic personnel search equipment for special nuclear material (SNM) storage and use areas.

Material control and accountability activities are being upgraded through improved material assay and other measuring systems. Technology advancements have been made in security and safeguards components and systems for application to nuclear weapons and fuel cycle facility upgrade projects, including new facilities. Advancements include CCTV assessment systems; an automated plutonium vault inventory system; a central alarm and assessment system designed for a large nuclear fuel cycle complex; SNM portal monitors; an enhanced "two person" role in SNM storage areas; a nondestructive assay system for spent naval fuel; and related measurement assurances that material will not be diverted for unauthorized purposes.

Rotor-wing response aircraft were obtained at Idaho, Nevada, and Savannah River.

We have developed and distributed to the International Atomic Energy Agency (IAEA) inspectors substantially improved and efficient safeguards instrumentation and equipment which will enhance the safeguards mission of the IAEA.

The Operations Security (OPSEC) Program was revitalized, and a DOE Center for Operational Security was established at the Los Alamos National Laboratory. This program is aimed at assisting the field in better understanding the hostile intelligence threat to facilities involved in nuclear weapons and fuel cycle program activities and promoting modifications to counter that threat.

In conjunction with other organizations within the Department, we established and managed a program called "Tempest"—which was designed to improve DOE capabilities for protecting classified computer operations from issuing compromising electro-magnetic emanations.

Efforts continue to provide timely intelligence to field elements on current events including notifying the field more quickly about threats to other governmental operations so that our security forces are prepared for action.

We have recently established a program that will examine the consequences of sabotage directed against major components of the electric utility systems which

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supply power to DOE weapons and production facilities, the Strategic Petroleum Reserve, and other agencies that rely on electric energy during crisis situations.

We completed a major modernization of weapon classification policy and issued a revised comprehensive joint DOE/DOD nuclear weapon classification guide.

We also continued development of an automated data base for classification guidance, precedent documents, and open literature references to classified subject areas. This is an area that continues to become more significant as new technology emerges. Moreover, as interaction with other governments increases, the need for a modernized, streamlined, and responsive classification program is imperative.

THE BUDGET

The Nuclear Safeguards and Security budget request for Fiscal Year 1986 is $59.9 million, about the same as for last year. Operating expenses require $54.3 million, capital equipment $4.6 million, and construction $1.0 million.

The safeguards and security program strategy requires that our Fiscal Year 1986 authorization request directly support operational, developmental and construction activities. Operational activities include: technical assistance, in terms of system interface, upgrades, and improvements required to address vulnerabilities identified by onsite evaluations: protective force training; nuclear materials management, control, and accounting; and the management oversight of the New Brunswick Laboratory. Developmental activities, which include research and development of physical protection systems, hardware, and technology to strengthen the overall safeguards and security program, are conducted by the national laboratories for application by the Department's field operations. Construction activities include the construction of a Nuclear Safeguards Technology Laboratory at Los Alamos, which is badly needed to improve material control and accountability.

The safeguards and security authorization request does not provide funding for the construction, capital equipment, and operating expenses of Department-wide safeguards and security systems at our field facilities. These costs are budgeted for and expended by the Department's outlay programs, which include the nuclear weapons, nuclear materials production, and the civilian nuclear energy and energy research programs.

In view of the potential consequences of a malevolent act at one of our sites, protecting our Nation's nuclear weapons, nuclear materials, and sensitive and unique facilities is a tremendous responsibility that challenges the capabilities of the foremost experts and management. We rely on a cadre of Federal, contractor, and national laboratory representatives to meet this challenge. Due to the changing nature of the threat to DOE facilities, new, more sophisticated protection programs continually need to be developed to effectively safeguard our resources.

Mr. Chairman, the Fiscal Year 1986 authorization request of $59.9 million consists of the following six basic elements which I will address in greater detail. These include: safeguards and security operation, technology development, international safeguards, classification, construction, and program direction.

SAFEGUARDS AND SECURITY OPERATIONS

Activities included under the safeguards and security operations category provide direct support to the overall mission of protecting all sensitive Departmental resources, which range from completed nuclear weapons to classified documents. At the heart of this program is the continued need to establish a systematic approach to the safeguards and security problem which treats the dilemma as a whole rather than a partitioned problem.

Elements in this category involve three major functions: guidance and direct assistance to Departmental field operations for safeguards and security system improvements; oversight and operation of the nuclear materials management and safeguards system, which provides timely data on nuclear materials production, utilization, transfer, tracking, and storage; and the operation of the New Brunswick Laboratory, the safeguards analytical laboratory at Argonne, Illinois.

One of our highest priority efforts is to continue providing expert technical assistance to Departmental field operations managers to support the application of the most advanced safeguards and security technology and hardware to fit site-specific needs. Areas for improvement are identified through onsite inspections, vulnerability assessments, and field office requests. Site-specific assistance for identified improvements is planned for a number of key defense-related facilities. This effort is bearing significant dividends through the realization of noteworthy specific safeguards and security improvements at weapons and nuclear material production program facilities as mentioned previously.

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In Fiscal Year 1986, major efforts will continue to be expended to ensure the application of technology that has been developed in the Nuclear Safeguards and Security program to upgrade protective activities and to correct vulnerabilities throughout the complex. Based on comprehensive vulnerability analyses at select DOE sites, we will be implementing systems incorporating technological advances in access denial, delays, intrusion detection, surveillance, integrated security communications, and materials control and accounting. Personnel and material control and accountability systems will be installed at key DOE facilities to counter potential sabotage and diversion of materials by insiders.

Through guidance and technology, we will continue to expand our capability to neutralize attempts to interfere with the Department's communications or to penetrate information processing systems and to improve computer security. As previously mentioned, we intend to step up research and development and to increase the manpower dedicated to computer security functions. Activities will include an increased assessment of field operations to determine the existence of vulnerabilities to hostile intelligence efforts, more rapid development of advanced audio surveillance and suppression methods, and the continuation of developmental activities and training at an enhanced level for improved security of classified computer operations.

Technologically advanced special weapons and tactics training, with a particular focus on realistic combat situations, has become a critical ingredient in improving the capabilities of our protective forces at each of our facilities. We will utilize our Central Training Academy to assure the highest standard of readiness throughout DOE and to effect a uniform and professional approach to protective force training in tactical, legal, operational, and technical aspects of physical security.

A major effort will be undertaken to implement a human reliability program in Fiscal Year 1986. This program, which centers upon the insider threat by constantly monitoring the reliability of DOE and contractor employees, should be fully developed and partially implemented in Fiscal Year 1985.

[Deleted.]

We will continue to operate the DOE's Nuclear Materials Management and Safeguards System, supported jointly with the Nuclear Regulatory Commission (NRC). It is the Nation's single nuclear materials computerized data base for tracking the location of nuclear materials in the United States and for recording the shipment of nuclear materials to and from foreign countries. Each year, approximately 78,000 nuclear material transactions (e.g., shipments, receipts, inventory changes) from 93 contractors and 1,400 licensees are entered into this system. The Department's nuclear materials tracked by this system are worth approximately $10 billion.

We also continue to directly support and to utilize the New Brunswick Laboratory, which serves as the United States Government's safeguards analytical laboratory and provides reference materials and services to DOE and the NRC on a cost-reimbursable basis. The laboratory's measurements, reference material standards, and inventory verification services fulfill safeguards requirements essential for the control and accounting of nuclear materials.

TECHNOLOGY DEVELOPMENT

Technological development continues to be an integral part of our safeguards and security program since advanced technology is necessary for improved protection systems for DOE nuclear facilities. Research and development conducted by the national laboratories provides us with a technological base to be used in safeguarding the Department's nuclear facilities and materials and to assist the NRC and its licensees. Efforts are directed toward the development and testing of new technology, components, and systems for entry control, intrusion detection, explosives detection, use-denial, and detection-surveillance assessment for airborne intrusion to increase our effectiveness against a wide spectrum of threats.

As I previously mentioned, one of my major areas of concern is material control and accountability. Improvements in controlling and accounting for nuclear material have been realized this past year but even greater enhancements are being sought. These will include projects to measure specific nuclear materials that are inherently difficult to measure, such as those that are inside processing equipment and are, therefore, inaccessible for measurement by conventional methods. Techniques and systems that can be used nondestructively and remotely, thus contributing to safe operations and providing efficient measurements such as for highly irradiated reprocessing dissolver solutions and enriched uranium in process gas, will continue to be investigated. Emphasis will be given to technology to track and confirm the presence of nuclear materials at key locations within a facility. We are em-

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phatically pursuing systems engineering development to integrate measurement processing and other subsystems into an effective material control system capable of improving our detection capabilities against insider threats. These systems will become an integral part of the master security system.

Our present research and development activities are closely coordinated with ongoing developmental efforts of the Nuclear Regulatory Commission and Department of Defense to avoid duplication and to ensure exchange of information and technology. We regularly explore the feasibility of joint research efforts that would be of mutual benefit in order to reduce the cost of such activities to each agency and the United States Government. We intend to broaden the coordination of research and development with the Department of Defense and other appropriate agencies in the near future to further minimize costs and eliminate duplication. I am very proud that our physical protection technology data base is the focal point from which numerous United States' agencies have incorporated our proven research and development innovations into their site-specific requirements which resulted in saving millions of taxpayers' dollars.

INTERNATIONAL SAFEGUARDS

Our international safeguards program supports U.S. nonproliferation and national security objectives of minimizing the proliferation of nuclear weapons. Its principal objective is the strengthening of international safeguards effectiveness through technical support to the International Atomic Energy Agency (IAEA) and cooperative efforts with other nations. Activities will include: continued development of procedures and instrumentation for safeguarding spent fuel reprocessing facilities; development of advanced containment and surveillance systems utilizing closed circuit television and an advanced fiber optic security seal which can be verified in the field, thus alleviating the need to transmit the seal to Vienna (IAEA Headquarters) for verification: continued development of safeguards for application at the new Gas Centrifuge Enrichment Plant (GCEP) at Portsmouth, Ohio, which is currently under IAEA Safeguards inspection; development and testing of instrumentation for nondestructive assay (NDA) of nuclear materials at nuclear facilities; and training of foreign personnel to perform safeguards and security functions in their own country in accordance with Section 202 of the Nuclear Non-Proliferation Act of 1978.

A major emphasis of the program is an aggressive effort for bilateral cooperation with other nations to improve safeguards. As an example, recent discussions and demonstrations of nondestructive assay equipment in Brazil are encouraging and illustrative of our commitment to assist other nations in the development and implementation of safeguards systems. In addition, the Department will continue its cooperative research, development, and testing of safeguards equipment and techniques with the safeguards laboratories and inspectorates of the European Community (Euratom) and the IAEA. In order to maximize research dollars, we routinely transfer domestic research and development technology that may have application to our international safeguards program.

Compliance with international agreements and nonproliferation objectives requires tracking international shipments of United States materials and shipments of foreign materials in the United States. Continuing activities include recording exports, imports, and transfers of materials of foreign origin in the United States; reporting to the International Atomic Energy Agency under the United States/International Atomic Energy Agency Agreement; and determining inventories of nuclear materials for bilateral agreements.

CLASSIFICATION

The fiscal year 1986 authorization request for the Classification program, which is incorporated in the Nuclear Safeguards and Security program budget, is $3.8 million. The Office of Classification is responsible for implementing and managing the Department's classification and declassification program.

In keeping with its responsibility to maintain credible and up-to-date classification policies and guidance, the Office of Classification has continued to seek support in the form of technical studies and analyses. Areas under consideration during the past year have included Nuclear Directed Energy Weapons (NDEW), vulnerability information, and radioactive material dispersion. In addition, a program was developed for the review of sensitive nonnuclear technologies, and a major consolidation of all safeguards and security classification guidance was completed.

The Fiscal Year 1986 request will initiate the development of a system for tracking open literature references to classified subject areas and additional technical analyses in support of classification guidance development. Fiscal Year 1986 classifi-

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cation policy activities will concentrate on such areas as directed energy weapons, computer codes, inertial confinement fusion, and advanced isotope separation. Work will include a major revision to the classification education and appraisal functions. The development of an automated information retrieval system for all classification guides and precedent-setting documents will be completed.

CONSTRUCTION

A New Nuclear Safeguards Technology Laboratory (NSTL) to be located at Los Alamos will be constructed to improve our research and development effort in safeguards and security technology area. The purpose of this project is to provide for centralized instrumentation development laboratories specifically designed for safeguards requirements; urgently needed space for the development, testing, and evaluation of measurement and accountability systems for implementation in DOE nuclear facilities; and facilities to support rapid transfer of advanced safeguards technology to the nuclear community.

An additional benefit of the NSTL will be improved security of special nuclear materials. At present, the safeguards research and development facilities are not in a security area. Because of this, nuclear materials must be transported from a different site, guarded by armed personnel while in use, and returned to the original site at the end of each day. The NSTL will be a materials access area within a protected area. Thus, during required periods, the daily transportation of SNM over public access roads between an offsite vault and the safeguards laboratories will be virtually reduced to zero.

The total estimated cost of this facility is $10.6 million, with $1.0 million requested in Fiscal Year 1986 for building design and construction of an access road.

PROGRAM DIRECTION

Our program direction supports a total of 137 full-time equivalent positions, which includes the staff for the classification program.

SECURITY INVESTIGATIONS

The Fiscal Year 1986 authorization request for personnel security investigations is $33.4 million. Background investigations are required by the Atomic Energy Act of 1954, as amended, and by Executive Orders 10450 and 10865. The Department is not permitted to conduct its own investigations; hence, we rely on and reimburse the Federal Bureau of Investigation (FBI) and the Office of Personnel Management (OPM) for conducting investigations on Department of Energy employees assigned to critical sensitive positions, contractor employees, and consultants prior to their being granted access to classified information, classified materials, or special nuclear materials.

In order to have efficient program management and be consistent in meeting security requirements, we use this single program to meet the strict requirements of the Atomic Energy Act of 1954 to ensure that granting access to classified information, classified material, or special nuclear material will not endanger the common defense and security. Most background investigations directly support Defense Programs activities; however, all security investigations are funded under Defense Programs since the Department believes any clearance or access determination is directly related to protecting the common defense and security.

A current problem in this area is the length of time it takes to conduct a background investigation. The time period for OPM investigations has approximately doubled over the last few years and now takes about 200 days. We have been informed by OPM that they have taken the necessary actions, including the hiring of contractor investigators, to remedy this problem. We should see some relief in our backlog by mid calendar year 1985.

We continually improve the effectiveness of our clearance program by such means as requiring DOE contractors to perform more stringent preemployment checks.

The projected cost for a single FBI background investigation is $1,850, and the projected cost for an OPM background investigation is $1,625. National Agency Checks are expected to continue to cost approximately $10 each. Our budget request provides for approximately 29,960 full-field investigations and National Agency Checks, which is a net decrease from the current fiscal year of approximately 1,170 investigations.

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SAFEGUARDS AND SECURITY CROSSCUT

To this point, I have been discussing the funding request for Security Affairs' programs. The DOE outlay programs provide the funding for the actual construction, capital equipment, and operating expenses for safeguards and security activities relating to their programs at the Department's field facilities. Total safeguards and security funding is collectively reflected in the Department's safeguards and security crosscut estimate, which is an administrative summation of all safeguards and security items in the Department's program requests, including the request for the Office of Safeguards and Security (OSS), with the exception of the Office of Classification component. The crosscut estimate for Fiscal Year 1986 totals $712 million.

We continue to have a range of responsibilities with respect to safeguards and security crosscutting activities. We continue to ensure that safeguards and security related budget submissions of all DOE organizations properly reflect judgments that have been made with respect to facility responsibilities. In addition, OSS has been identified as the Departmental focal point for all DOE safeguards and security activities. One aspect of the OSS focal point role is the consideration to assign to OSS the functional responsibility for budgeting, justifying, and validating all Defense Programs safeguards and security line-item construction projects. This matter is still under discussion within DOE, and I will inform you of the final decision.

VERIFICATION AND CONTROL TECHNOLOGY

I would now like to discuss the Fiscal Year 1986 budget request for the Verification and Control Technology program. This program has four specific goals:

To develop and produce the technology to monitor foreign nuclear explosions conducted underground, in the atmosphere and in space, and to monitor compliance with nuclear weapons-related treaties.

To control proposed exports of nuclear and energy-related materials, equipment and technology to ensure such exports are consistent with U.S. national security and with nonproliferation policy.

To provide technical and analytical support for DOE's role in nuclear arms control negotiations, policy formulation, and implementation.

To meet DOE intelligence requirements and to provide DOE's unique weapons and nuclear-related expertise to the Director of Central Intelligence (DCI) and the Intelligence Community.

As I mentioned earlier, the funding for DOE intelligence activities is included in the Verification and Control Technology line item of the Defense Programs budget, and I will cover those activities. Deputy Assistant Secretary Boykin is available to respond to your specific questions.

INITIATIVES

Before discussing in detail the specific program areas for which funding is requested, I would like to call your attention to a number of initiatives that the Verification and Control Technology program has carried out recently.

Four satellites carrying Department of Energy (DOE) instrumentation for monitoring treaty compliance of nuclear detonations in the atmosphere and in space were launched in 1984.

[Deleted] satellite payload systems for detecting, locating, and determining yield of nuclear detonations in the atmosphere and in space were completed for future deployment.

To reduce funding outlays, molded plastic parts have been developed, and replaced machined metal parts to save 80 percent in cost and 40 percent in weight in DOE's satellite instrumentation systems.

In response to the President's call for negotiations leading to direct yield measurements by the United States and the Soviet Union at each other's test sites in order to improve verification of compliance with the Threshold Test Ban Treaty (TTBT), an expanded program of research on direct yield measurements under expected TTBT conditions has been initiated at the Los Alamos and the Lawrence Livermore National Laboratories.

A major review of teleseismic data gathered over the last decade pertaining to questions of Soviet compliance with the Threshold Test Ban Treaty was completed. As a result, more meaningful technical conclusions can be presented to policy and decisionmakers.

The Norwegian Regional Seismic Array (NRSA), which will be used for the detection and identification of underground explosions, was installed in Norway and began operation at the end of September. Like the Regional Seismic Test Network

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in North America, the NRSA transmits data in real time via satellite to analysis centers in the United States.

The Regional Seismic Test Network (RSTN), a five-station network located in the United States and Canada, has completed two years of highly successful operation. This network serves as a prototype for a regional monitoring network in the Soviet Union for a possible future comprehensive test ban treaty.

In 1983, Defense Programs evaluated over 5,000 nuclear export applications. The nuclear export application workload expanded by 40 percent in 1984 to about 7,000 cases but, through improved management procedures, including automated data bases and laboratory support, the workload has been met.

The U.S./U.K. Mutual Defense Agreement, which provides for the exchange and transfer of nuclear weapons information and materials, was extended through 1994.

THE BUDGET

Turning now specifically to the Verification and Control Technology budget, our request for Fiscal Year 1986 is $93.6 million which includes $83.5 million for operating expenses, $5.6 million for capital equipment, and $4.5 million for construction. The operating expense figure includes $3.8 million for program direction. Activities supported by operating expenses fall into two functional categories: detection technology and analytical support, both of which draw upon the unique expertise, skills, and resources of the national laboratories of the nuclear weapons complex.

The Fiscal Year 1986 increase of $9.3 million in operating expenses (exclusive of program direction) over Fiscal Year 1985 is attributable mainly to increased satellite sensor deliveries which DOE must make for various satellite systems and for our base technology program.

[Deleted.]

Beyond the increase in operating expenses, the Fiscal Year 1986 request also allocates $4.5 million to continue construction of a Space Science Laboratory supporting satellite fabrication and technology development efforts at Los Alamos. Total estimated cost is $7.5 million, with completion in late 1987.

DETECTION TECHNOLOGY

Detection technology encompasses technologies related to the detection of nuclear weapons activities—spaceborne sensors, seismic and nonseismic techniques, debris detection, sample analysis, and other scientific efforts. Our activities are designed to respond to treaty verification [deleted].

The Fiscal Year 1986 budget request for detection technology activities is $58.6 million, a $7.6 million increase over the Fiscal Year 1985 level of $51.0 million. The increase is to meet requirements for acceleration of the spaceborne sensor delivery schedule, to increase the current level of effort in Directed Energy Verification, and in the investigation of advanced sensor concepts.

SPACEBORNE SENSORS

The overall purpose of our space effort is to develop and maintain United States capability to detect, locate, [deleted] nuclear explosions from spaceborne platforms [deleted]. The effort includes research and development, the actual fabrication of sensor packages, and operational support, which provides for calibration and testing of subsystems and evaluation and analysis of data collection, processing and exploitation. [Deleted.] Additional funds are required in Fiscal Year 1986, however, to procure long leadtime items for Fiscal Year 1987-88 production. The main carriers of DOE-made sensors are the Global Positioning System (GPS—which provides a navigational capability for the military) [deleted]. All DOE sensors ride the satellites on a secondary mission basis. When the GPS system is fully deployed in the late 1980's, our sensors on board will be able to locate atmospheric nuclear explosions [deleted].

In conjunction with the Air Force, we provide operational support for the DOE sensors. We maintain the readiness of sensors delivered to the spacecraft manufacturers [deleted].

Underpinning the production and operational support elements of the detection technology effort is a base technology effort to conduct research to define future instrument needs, advance the underlying science and technology, and develop new instrument system concepts and configurations. This effort addresses the earth and space background in which the instrument systems must both survive and function, the nuclear weapons effects environment in which the instrument systems must survive, the special reliability requirements inherent in secondary mission payload

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status, and the additional requirement that systems launched by shuttle must be man-space-qualified.

DIRECTED ENERGY VERIFICATION

Due to the increased U.S. and Soviet activity in directed energy technologies, we have begun the development of a technology base for treaty verification monitoring support. Instruments are required immediately to remotely detect, identify, and characterize directed energy experiments and devices. The program will exploit DOE directed energy programs, such as accelerators, to provide emission sources and, by combining the unique expertise available within DOE on both directed energy and emission detectors, will avoid costly duplication of facilities or staff. This program will emphasize the definition of an adequate near-term capability using existing sensors and platforms where possible, while conducting research and engineering development on systems which will provide enhanced capabilities in the future.

TECHNOLOGY DEVELOPMENT

Efforts will continue toward development of new technologies to enhance current measurement capabilities or to provide entirely new techniques of measurement to support our verification and detection effort. Such efforts require highly specialized research, capitalize on unique DOE laboratory expertise and capability, and assist DOE in maintaining its leadership role in verification and monitoring technology. Advanced concepts currently include x-ray imaging, fiber-optic seismometers, and fiber-optic detectors.

The latter concept, while early in its development cycle, may have a major impact on verification detection technology.

DEBRIS DETECTION AND SAMPLE ANALYSIS

United States nuclear test detection capabilities are currently focused on the Northern Hemisphere. [Deleted.] In the near term, other sensor systems to monitor remotely the nuclear debris could assist in the Southern Hemisphere coverage as well as provide corroborating data sources. The Department has successfully demonstrated the capability of remotely sampling the atmosphere for nuclear debris using free-floating, buoy-type marine platforms. This technology is being adapted for remote land application. A network of surface air sampling stations is in place around the world to aid in detecting nuclear weapon tests in the atmosphere. [Deleted.]

[Deleted.] DOE also is studying ocean area background radiation and the mechanisms of debris transport to provide data for development of sensor deployment strategies. The technical analyses being performed in this program will contribute significantly to a basic understanding of Southern Hemisphere ambient levels, radionuclide deposition patterns and air mass movements. [Deleted.]

SEISMIC

DOE's in-country seismic program was established to support research and development for developing enhanced seismic verification capability at regional (short range) and local distances and to ensure that DOE can provide in-country seismic equipment/systems to support United States verification of future nuclear test ban treaties. The operation and maintenance of DOE's Regional Seismic Test Network (RSTN) will continue to be conducted at the Fiscal Year 1985 level. This five-station network, located in the United States and Canada, is a research tool being operated to gain operating experience with such a system and on how an in-country seismic system would be used to monitor compliance with nuclear testing bans or restrictions through the detection of regional versus teleseismic signals. The RSTN provides the opportunity for regional seismic experiments including the collection of data for input to the regional seismic discriminant studies being conducted at Lawrence Livermore National Laboratory; i.e., how to distinguish between seismic signals generated by underground nuclear explosions and those generated by earthquakes, mine excavation activities, and other seismic signals. Additionally, the RSTN provides data on the reliability of high technology seismic data collection apparatus operating under field conditions.

An advanced element of DOE's in-country seismic research program is the design, development, deployment, and operation of a regional seismic array system in Norway. This is a cooperative effort between DOE and Defense Advanced Research Projects Agency (DARPA). The DOE and DARPA deployed and began operating an

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array system in 1984 under existing arrangements between DARPA and Norway. In Fiscal Year 1985, the array will achieve complete operational status and will collect regional seismic data for two to three years. The data from the array will provide an additional basis for evaluating the utility of an array system for verifying compliance with treaties limiting or banning underground nuclear tests. In Fiscal Year 1986, development and installation of a second advanced seismic station or array will begin, in cooperation with cognizant United States agencies. [Deleted.]

The nonseismic detection (ionospheric and infrasonic monitoring) technology development program efforts in Fiscal Year 1986 will focus on developing equipment and signal processing techniques for operational systems. The ionospheric technique uses over-the-horizon radar for monitoring perturbations in certain levels of the ionosphere caused by shock waves generated from nuclear explosions. Microphone arrays for long-range monitoring of very low-frequency sound waves generated by nuclear explosions that propagate in the upper levels of the atmosphere are used in the infrasonic technique. Both programs have demonstrated the capability of detecting nuclear explosions and are developing the methodology for optimizing measurement and signal processing procedures. The infrasonic and ionospheric monitoring systems would prove to be valuable test treaty verification tools since neither would have to be deployed within the borders of a country to verify its compliance with any nuclear testing constraints. To this end, Fiscal Year 1986 emphasis will be on the design and development of equipment and processing techniques of prototype systems for supplementing existing verification methods.

ONSITE MONITORING

The Peaceful Nuclear Explosions Treaty (PNET), which like the Threshold Test Ban Treaty (TTBT) is not ratified, provides for the United States and the Soviet Union to conduct observations and examinations on each other's territories for certain peaceful nuclear explosions.

DOE has an initial equipment suite and has identified personnel with the skills needed to implement an onsite program to exercise United States monitoring immediately, if and when the PNET is ratified. The Fiscal Year 1986 funding request will enable DOE to maintain the equipment in readiness. However, if the treaty is ratified, additional resources will be needed to assemble an operational team and to fabricate specialized deployable equipment for the long term.

[Deleted.]

ANALYTICAL SUPPORT

Our work in Analytical Support provides valuable assistance to the Departments of State, Defense, and Commerce; the Arms Control and Disarmament Agency; the Intelligence Community; and the Nuclear Regulatory Commission, as well as DOE.

The Fiscal Year 1986 budget request for analytical support activities is $21.0 million, a $1.5 million increase over the Fiscal Year 1985 level of $19.5 million.

[Deleted.]

ARMS CONTROL

DOE's responsibility for the United States nuclear weapons program makes essential its participation in the arms control process. Our capability to meet national security requirements demands continuing assessment of the impact of arms control policy on the nuclear weapons complex. At the same time, United States arms control policy must take account of the Nation's nuclear weapons requirements. This relationship between the nuclear weapons program and arms control requires active DOE participation in arms control policymaking, negotiation, and implementation.

We have the primary responsibility for Defense Programs activities in the interagency and international arms control arenas. We participate in the Non-Proliferation Treaty (NPT) Review Conferences, the United Nations Conference on Disarmament (CD), and negotiations on possible nuclear test limitation agreements. We participate in the Interagency Working Group on Nuclear Weapons Testing and in the Arms Control Verification Committee (ACVC). We also participate in the CD Backstopping Committee which provides direction to our United States delegation to the CD in Geneva. We send a representative to serve on the United States delegation to the CD during the 24-week session in Geneva.

Two CD working groups now use DOE's technical expertise: one is negotiating a treaty banning radiological weapons; the second is investigating verification and compliance issues associated with a Chemical Warfare Treaty. DOE also provides representation to the CD Ad Hoc Group of Scientific Experts, whic his conducting a

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data exchange program on information relating to an international network of seismic facilities.

EXPORT CONTROL, TECHNOLOGY TRANSFER, AND INTERNATIONAL EXCHANGE

We are responsible for reviewing proposed nuclear and energy-related exports, technology transfer, and international cooperation and exchange agreements to ensure their consistency with United States national security and nonproliferation objectives.

Because of the unique experience and resources of the DOE nuclear weapons complex, we have been called upon to support the DOD in identifying emerging and militarily critical technologies and to support the Departments of State and Commerce in carrying out their responsibilities for controlling United States exports and international cooperation and exchanges. We are currently intensively examining these issues to ensure that the controls, as written, are adequate and to recommend changes where appropriate. It is also the responsibility of DOE to determine for the Executive Branch whether a request for a Nuclear Regulatory Commission license to export nuclear materials, reactors, and equipment specially designed for nuclear purposes would be inimical to United States national security interests. Similarly, our expertise provides the basis for control of naval and maritime nuclear propulsion technology in coordination with DOE's Office of Naval Reactors.

In addition to applications for DOE authorization to assist foreign nuclear activities, we review about 200 NRC export license applications a year and about 6,500 Department of Commerce export license applications. In 1984, we acted on about 92 percent of the Commerce cases within the initial 30-day period mandated by the Export Administration Act. The remaining 8 percent required additional time for detailed technical analysis and, in some cases, review by the Subgroup for Nuclear Export Coordination (SNEC). (The SNEC is an interagency panel established to consider and consult on proposed nuclear exports and related issues.

WEAPONS INTELLIGENCE

Weapons intelligence within the Department of Energy is responsible for supporting DOE and Intelligence Community collection, identification and analysis of data on foreign weapons [deleted].

[Deleted.]

PROLIFERATION INTELLIGENCE

The DOE proliferation intelligence program supports U.S. nonproliferation goals with a program of studies of nuclear capability in potentially proliferating countries. [Deleted.]

[Deleted.]

The foreign technology assessments [deleted] activity examines directed energy-related technologies, computers and microelectronics, technology transfer, and nuclear terrorism. This activity supports decisionmaking on export case reviews, foreign cooperation visits and programs, and strategic analyses at both DOE and other U.S. Government agencies in the carrying out of legislative and executive mandates. This effort includes support to the National Security Council and Senior Interagency Group for Technology Transfer (SIG/TT). The effort for these activities will continue at the Fiscal Year 1985 level.

[Deleted.]

ENERGY ASSESSMENTS

Current intelligence on energy security meets the Department's needs for information on the prospects for disruption of oil supplies due to political, economic, and social instabilities within major producing nations of the Persian Gulf. The status of the Iran/Iraq conflict plus potential future threats or conflicts among the states must be analyzed and reported relative to the vulnerability and recovery capability of this vital world energy source as it may influence United States energy supply.

[Deleted.]

CAPITAL EQUIPMENT

The Fiscal Year 1986 request for capital equipment for the Verification and Control Technology program is $5.6 million, a $3.6 million increase over the Fiscal Year 1985 figure of $2.0 million. This year's request adds funds for automating the processing of intelligence and crisis management information within the Department.

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Included is an upgrading of communication between DOE Headquarters in the Forrestal building and the DOE Emergency Operations Center in Germantown, Maryland. The Germantown facility is responsible for processing all of the Department's intelligence and crisis management information during other than regular duty hours. The application of automatic data processing techniques to the handling of the Department's intelligence and crisis management information will improve the Department's ability to respond to oil supply disruptions, nuclear accidents, reentry of nuclear powered space vehicles, support for nuclear terrorist incidents, and support for the Nuclear Emergency Search Team. Additionally, this capital equipment request supports research, development, test, and production activities through the provisions of test equipment and instrumentation. There is a continuing need to update test equipment at the Sandia National Laboratories, the Lawrence Livermore National Laboratory, and the Los Alamos National Laboratory. Most equipment is small-scale bench test equipment such as oscilloscopes, electronic calibration devices, and small-scale electronic support devices.

CONSTRUCTION

To ensure that we can meet requirements for spaceborne sensors in the late 1980's and beyond, the Department is requesting $4.5 million to continue work on the Space Science Laboratory (Project 85-D-171) at Los Alamos. Work on the laboratory has been started under the Fiscal Year 1985 appropriation of $1.0 million. The funds requested in Fiscal Year 1986 will permit the work to move smoothly from engineering design to construction. The Laboratory will be completed by Fiscal Year 1987 at a total estimated cost of $7.5 million.

This facility will enable us to perform an unprecedented plannned workload of technology development, fabrication, and operational support activities. The new capabilities it will provide are essential if the Department is to carry out several classified research and development projects which will be very important to the Nation's security in the 1990's. These projects pose significant technological challenges to our scientists and engineers, in some cases calling for development of virtually new technologies before even prototype sensors can be deployed. Present facilities can barely meet the technical demands of current research and development and fabrication activities, much less the development of new technologies and the stepped-up fabrication and delivery schedule. In addition to impeding the successful development of new technologies, our present facilities would probably increase the cost because the sensors would have to undergo manual testing, which not only is less likely to meet stringent quality assurance standards but also is very time consuming and increases the risk of missing a delivery commitment.

Another factor contributing to the need for the new facility is that most satellites on which DOE sensors will ride will be deployed by the space shuttle. Unlike satellites launched by unmanned rockets, shuttle-deployed satellites must meet more rigorous quality and testing standards to ensure the safety of the shuttle crew.

PROGRAM DIRECTION

Program direction funds provide for the salaries, benefits, and travel expenses for 67 FTE's associated with the management and direction of the Verification and Control Technology program at DOE Headquarters in Washington, D.C. These employees are responsible for technical and analytical program management of field activities, and execution of Headquarters staff functions.

The requested funding of $3.8 million, an increase of $.6 million over the Fiscal Year 1985 figure of $3.2 million, provides for full year staff support, employee advancement, and normal administrative costs.

This completes my statement. If there are any additional questions or requests, I will be glad to respond now or at a later date.

Senator WARNER. If there are no questions at this juncture, gentlemen, may I suggest that we go ahead with Dr. Wagner.

STATEMENT OF HON. RICHARD L. WAGNER, JR., CHAIRMAN, MILITARY LIAISON COMMITTEE TO THE DEPARTMENT OF ENERGY, AND ASSISTANT TO THE SECRETARY OF DEFENSE FOR ATOMIC ENERGY ON NUCLEAR WEAPONS PROGRAMS

Dr. WAGNER. Thank you, Mr. Chairman.

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As you mentioned in your introduction both yesterday and at other times, this subcommittee reviews the particular weapon production requirements that are stated in the joint Nuclear Weapons Stockpile Memorandum.

I would not propose to talk at all about those today. I would like to talk instead about the Department of Defense interest instead in some longer term issues, some of which General Hoover touched upon, those being the research and development base and the nuclear materials production capacity, the health and resilience of both of those things.

The Department of Defense has become increasingly concerned over the last few years about the progress in research and development for DOE, and nuclear materials production.

In development of the DOE budget, the Secretary of Defense, within the Administration, has been active himself in supporting not only weapon production but R&D and nuclear materials to the levels that are in the budget proposal.

I have with me today three members of the seven-member Military Liaison Committee which I chair, which is the statutory link between the Department of Defense and the Department of Energy: Maj. Gen. Kent Davidson, representing the Air Force, Brig. Gen. Sidney Davis, representing the Army, and Comdr. Roger Bacon, representing the Navy.

Their presence today I believe indicates that it is not only OSD that is concerned about the research and development and the health of the technology base in DOE but the services as well.

For instance, the Joint Chiefs several times during the past year have devoted meetings to looking in particular at the long-term nuclear materials requirements and also the research and development base.

Five years ago, the two Departments participated in a study of the entire interaction between the two Departments, chaired by Lt. Gen. Dodd Starbird, called the Starbird Study. Among the other recommendations, it recommended an increase in the research and development manpower at the laboratories from, at that time, about 7,400 direct full-time equivalents, to about 8,500.

One of my bottom lines is because of things that have developed during the last few years, the level of about 8,500 heads we feel is no longer appropriate, and there ought to be a continued growth during the next few years toward a higher level, perhaps on the order of 9,500 or so.

To do that is going to require full support this year in the 1986 budget of the $1.9 billion research, development, and testing line that the Department of Energy is asking for.

I would like to go through a few Vu-Graphs for you, if I may, which will illustrate how the DOD interest in nuclear weapon research and development, as opposed to production, is reflected. I will speak from over here, if I may.

At the time of the Starbird study, which laid out the long-term direction for the R&D manpower, we were beginning to see [deleted].

Dr. WAGNER. [Deleted.]

[Chart deleted.]

[Deleted.]

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[Chart deleted.]

[Deleted.]

This is one of perhaps a dozen examples that I could give.

Let me turn to another aspect which Senator Hart and General Hoover touched upon as recently as a minute ago, another thing which was simply not part of our understanding of the future in 1980, when we laid out the long-term plan for the R&D jointly in this area, and that is the strategic defense initiative.

There has been some confusion, I am afraid prompted a little bit by statements coming out of DOD itself in the past, about the extent to which nuclear research plays a role in the SDI.

To clarify this, partly in response to earlier questions from staff members on this committee, a few weeks ago, Secretary Weinberger and Secretary Herrington signed the following statement, which I would like to read to you, because there is a subtle point involved here and I want to make sure that we have it clear.

This is entitled "Policy for Nuclear Research in the Strategic Defense Initiative."

> The SDI is a program of vigorous research focused on advanced defensive technologies with the aim of finding ways to provide a better basis for deterring aggression, strengthening stability, and increasing the security of the United States and our allies. As a broad research program, the SDI is not based on any single or preconceived notion of what an effective defense system would look like, but the long-term goal of the research program is a truly effective non-nuclear defense. There are, however, some new concepts which could, if proven feasible, convert nuclear energy in a carefully directed, controlled way, so as to destroy attacking missiles, after they are launched, at a great distance. Unlike the thinking of the past, these new concepts would not use the effects close to the explosion of nuclear weapons to destroy the attacking missile, and they would be controlled so that there would be no harmful effects from a nuclear source. There are a variety of reasons for including research on such concepts at this time:"

And here I will stop the quotation. Let me say that they include the kinds of things that General Hoover mentioned.

> UTILITY OF NUCLEAR RESEARCH
>
> Exploring Soviet Union threat/posture: nuclear SU counterdefense vs US defense; nuclear SU defense.
>
> US defense: possibility of US nuclear SDI as powerful hedge against SU defense breakout; as part of actual US SDI as a way to get a defense-dominated world.

These would include exploring things that the Soviets could do in this area—[deleted]—and both deterring a possible Soviet breakout by the possibility that we could respond, and as part of a long-term SDI.

The distinction here is that what we see in the nuclear research area for SDI is a possibility of using a nuclear explosion as a power source that would produce what we regard as a qualitatively different use of nuclear weapons in defense than the way they were used a decade ago in the Safeguard and ABM systems which we deployed for 6 months and then dismantled.

This would be directing the energy in a beam at a target that is perhaps 1,000 miles away, and doing that with few enough such explosions, at such high altitude, and with the effects reduced in other ways, so that there are no harmful effects from that explosion.

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In the very long term, one hopes, then, that even that limited use of nuclear energy in the SDI could be eliminated, and a completely nonnuclear defense developed.

But in the nearer term in the SDI, this is a very important part of our plans.

General Hoover mentioned a few of the numbers, so let me just show you the matrix that summarize the joint DOD/DOE program.

FY 86 SDI FUNDING

	TARGET DESTRUCTION		SENSORs COMPUTERS & SUPPORT	TOTAL
	NUCLEAR POWERED	NON-NUCLEAR		
DOD FUNDED	20	1800 (60-100)*	1880	3700
DOE FUNDED	280	0	SMALL	280
TOTAL	2100		1880	3980

* AT DOE LABORATORIES

In this dimension, the DOD funding is along this line [indicating], and our request of $3.7 billion is shown here [indicating]. The DOE funding, the $280 million or so, is shown here [indicating].

We think of this program—and I will simplify this—in a couple of major parts: a part which is devoted to developing the mechanism for destroying a target at a distance, which I call target destruction, here, and all the rest of the systems—the sensors, the computers, the support, all of the ancillary equipment.

You will see that the total SDI budget for both Departments is about evenly split between those target destruction research projects and the ancillary equipment.

Within the target destruction research, there are these two categories, the nuclear powered and the nonnuclear.

You will see that perhaps six times as much attention is going into the nonnuclear research, the roughly $1.8 billion funded entirely by the Department of Defense, as is going into the nuclear-powered research, which is almost entirely funded by the Department of Energy, at $280 million—as opposed to the $1.8 billion.

An important part that we believe will grow in the future in this area is research at the nuclear weapons laboratories on completely nonnuclear target destruction techniques.

In the 1986 budget, we will plan, depending to some extent on how much of our budget is supported by the Congress, to spend $60 million to $100 million in those areas, and there is a very high leverage in the technology base at the Department of Energy laboratories for this nonnuclear work on the SDI.

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So, it is both the nuclear research, which we are committed to supporting, and it is carried in the DOE line, and what those labs are doing for us in the nonnuclear line.

Senator WARNER. On that chart, regarding the nuclear figure, did General Abrahamson come to you and make requests and then you attached a dollar figure to it? Give me the procedure for arriving at that figure.

Dr. WAGNER. We have a coordinating committee tht consists of me, as the chairman of the Military Liaison Committee, General Abrahamson, for DOD, for the Program Office, his Program Office, and Deputy Secretary Boges in DOE, and General Hoover in DOE. We get together once every 6 weeks or so, and more frequently perhaps during the time the budgets are being developed, and just work these things out jointly—how much DOE funding should be devoted to this area, how our request for research in the nonnuclear area at the DOE laboratories impacts their technology base and the tradeoffs. This is where I play a difficult role, I have to say, in the tradeoff between the research and the DOE labs on SDI and the research on what I might call the more traditional nuclear weapons R&D, of the kind that would be used to attack the targets and many other things. This is getting to be a particularly difficult tradeoff for us.

In order to support this level, the laboratories have dug into their research base, and I suspect you will hear that from the lab directors later. To the extent that we in DOD are concerned—that is why I am making such a big point—to the extent that we are concerned that the funding remain for the usual lines of nuclear weapon R&D, looking out into the 1990's, it is not going to be enough. [Deleted.]

So I would read a few paragraphs for you.

[Deleted.]

It has been at least a decade since there was this kind of latitude in the DOE program, although it was a major and distinguishing feature of the U.S. nuclear weapon program until about 1970.

So, I am concerned about the level of our RD&T in the DOE program.

Senator WARNER. Dr. Wagner, I want to try to arrange this hearing in a manner that meets as best as possible the various desires of all.

We have a strong attendance here at the moment. I am wondering if you could bring your remarks to a conclusion so that we could have a 5-minute round of questions of this panel, and then proceed to our laboratory panel. Following that, the Chair is perfectly happy to keep the hearing going as long as members have a desire for it.

Dr. WAGNER. I have only one more Vu-Graph to show.

Senator WARNER. Fine. Please continue.

Dr. WAGNER. It pertains to the other subject that we are concerned about, which is nuclear materials.

[Chart deleted.]

The U.S. nuclear materials production is shown over the years here. [Deleted.]

We feel very strongly that we must build some reserve capacity into the DOE nuclear materials production capability and particu-

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larly strongly that a highly leveraged way of doing that is by putting into place a special isotope separation facility in the DOE complex.

Mr. Chairman, that is all I had planned to say.

Thank you.

[The prepared statements of Dr. Wagner and the MLC members follow:]

PREPARED STATEMENT BY HON. RICHARD L. WAGNER, JR., CHAIRMAN, MILITARY LIAISON COMMITTEE (MLC) TO THE DEPARTMENT OF ENERGY AND ASSISTANT TO THE SECRETARY OF DEFENSE (ATOMIC ENERGY) ON NUCLEAR WEAPONS PROGRAMS

Mr. Chairman and members of the subcommittee, it is my pleasure to appear before you again this year to discuss the Department of Defense's perceptions of this country's nuclear weapons program—its importance, the requirements for it, and its adequacy. This year I would like to focus my comments on what I view to be both the strengths and weaknesses of the program. I have invited one member of the Military Liaison Committee from each of the military departments to accompany me in order to respond to questions concerning the specific nuclear weapons requirements of his service; their statements are attached to mine.

I would like to acknowledge the great service performed by former Senator John Tower in his role as chairman of the Committee on Armed Services. Senator Tower now serves as the U.S. Representative to the Arms Control Negotiations which will begin this week in Geneva. It is no coincidence that such outstanding leadership as that given by Senator Tower on this committee was sought for the Geneva talks. Nothing more amply demonstrates the U.S. commitment to an enduring peace through strength while striving for fair and verifiable arms reductions. I wish Senator Tower and his delegation the best on this important mission.

This year marks the fortieth anniversary of the end of World War II. During the past four decades, there has been no armed conflict between the United States and the Soviet Union, or between NATO and the Warsaw Pact—in contrast to the first 45 years of the twentieth century, in which we witnessed two global conflagrations. These past 40 years also represent the longest continuous period of peace Europe has known since the early nineteenth century. This is no accident. It is, in large measure, a result of the policy of deterrence adopted by the United States and the Western democracies in the wake of World War II, a policy designed to deter any aggression, either conventional or nuclear, against ourselves or our allies.

Even if we ignored the direct and indirect role of nuclear forces in deterring conventional attack, in a world where the knowledge of nuclear weapons cannot be banished, the United States would still have to maintain nuclear forces to deter nuclear attack on its allies and on itself. That does not mean we are under any illusions about the consequences of a nuclear war between the major powers; we believe that neither side could win such a war. This recognition on our part, however, is not sufficient to prevent the outbreak of nuclear war: It is essential that the Soviet leadership understand this as well.

But while we work to preserve deterrence, we must also think about and plan against possible failures of deterrence. If deterrence should fail, we must plan for flexibility in our forces and in our options for response, so that we might terminate the conflict on terms favorable to the forces of freedom, and reestablish deterrence at the lowest possible level of violence, thus avoiding further destruction. The ability to do this, of course, strengthens deterrence in the first place. This concept of seeking both to enhance deterrence, and to limit the level of destruction, by having flexible and enduring forces is not new. It has been squarely in the mainstream of American strategic thinking for over two decades.

Maintaining a stable strategic deterrent requires a variety of retaliatory strategic forces—a triad of land-based ICBMs, manned bombers, and submarine-launched ballistic missiles. The unique characteristics of the independent and separate components that make up the triad bolster deterrence by acting in concert to complicate Soviet attack planning, making it more difficult for the Soviet Union to plan and execute a successful attack on all these components while at the same time defending against their combined and complementary retaliatory effects. The triad also acts as a hedge against a possible Soviet technological breakthrough that could threaten any single strategic system. In addition to a strong triad, stability of deterrence in a crisis and the effective and responsible use of our nuclear forces depend on a responsive and survivable command, control, and communications system.

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While America's strategic nuclear systems are NATO's ultimate deterrent force, we also have nonstrategic nuclear forces in Europe to help deter a Soviet nuclear or major conventional attack on our NATO allies. This deterrence is founded on NATO's ability to retaliate against the Soviet Union and its Warsaw Pact allies in Europe, and on a clear Soviet recognition that the use of nuclear weapons risks engagement of the strategic nuclear systems of the United States.

The Department of Energy, in partnership with the Department of Defense and the Congress, has provided this deterrent capability to the United States by developing and producing the nuclear warheads to arm the retaliatory strategic forces as well as the nonstrategic nuclear forces. As the Soviet threat has evolved, so too has our strategy of flexible response, and the DOE has responded to this evolving strategy with new designs and new capabilities to maintain and enhance the flexibility of our responsive posture. They are full partners in establishing and continually improving our capabilities, thus preserving our posture.

However, their contribution goes beyond providing this concrete capability, as the Scowcroft Commission's first report stated what I mean succinctly:

"Deterrence is not an abstract notion amenable to simple quantification. Still less is it a mirror-image of what would deter ourselves. Deterrence is the set of beliefs in the minds of the Soviet leaders, given their own values and attitudes, about our capabilities and our will. It requires us to determine, as best we can, what would deter them from considering aggression, even in a crisis—not to determine what would deter us."

In previous testimony, I have discussed how the DOE advanced technology relates to what I called earlier "keeping the Soviets in a deterred frame of mind." Deterring the Soviets has often been thought of simply as a matter of keeping the Soviet attack exchange calculations unfavorable to them, both in our view and in theirs, thereby avoiding a Soviet attack. [Deleted.]

The Soviets have always been concerned with "image"—their obsession with propaganda and legitimacy shows that. Their images of themselves and of us, in the context of deterrence, are made up of many things—numbers and sizes of weapon systems, their technical characteristics, general technological capabilities of the two societies, national will, and purpose and place in the flow of history. [Deleted.] But, on the other hand, we know that tests between our technologies, such as U.S.-made jets versus Soviet-made jets over the Bekaa Valley in Lebanon, and the technology of our cruise missile developments, are often sobering experiences for them.

I believe these deterring perspectives extend also to the DOE-produced nuclear warhead technologies. [Deleted]. I am certain that the experience reinforced Soviet respect for DOE capabilities, a respect that continues to have deterrent effect.

What deterrence comes down to in the end, then, is to keep things so that, if a crisis comes that they might want to resolve by force, they will have a gut feeling that they won't measure up against us. It is often said that the Soviet leaders are conservative. They are when they feel inferior, but they often are not when they feel they have an edge; they often have taken advantage when they perceive an opportunity, such as in Cuba or Afghanistan. I believe that our level of technology in itself, quite apart from exactly how it is built into fielded systems, affects their overall image of themselves and of us, and thus can have a significant deterrent effect. [Deleted.]

In discussing what's right with the DOE nuclear weapon program, so far I have talked rather generally about its success in contributing to deterrence. More specifically, however, the DOE nuclear weapons development and production system has performed superbly in recent years. New weapon designs with greatly enhanced effectiveness, safety and use control features have successfully completed development. These designs, whose increased complexity is essential for deterrence, are being produced [deleted] actions to recover at least a portion of our previous capability to produce special nuclear material (SNM) have been initiated, and in some cases are already helping to satisfy our SNM requirements. Plutonium production in the Savannah River reactors, in combination with blending of non-weapons grade material, has exceeded expectations. Conversion of N reactor to weapon-grade plutonium production and reactivation of the Purex fuel processing plant have been accomplished. Upgrade of the L reactor was completed in 1983, and restart is scheduled for later this year. Upgrades of the uranium enrichment facility and the uranium metal conversion facility, which will restore the U.S. capability to produce oralloy for weapons, have begun, and development of both higher productivity reactor cores and special isotope separation continues.

Underground tests have also been conducted [deleted]. This test program has not only continued vigorous pursuit of basic physics understanding of nuclear explosives, but has included a series of nuclear tests of stockpiled weapons to verify confi-

dence in our deterrent. As further evidence of a healthy and innovative enterprise, the various concepts for so-called "third-generation" or nuclear driven directed-energy weapons have emerged in the past three years. Research on these concepts is at a very early stage [deleted].

[Deleted.]

Finally, these challenging development and production tasks were accomplished by the DOE in the midst of sweeping upgrades, across the entire weapon complex, of security and environmental controls. These upgrades involved improved facility features, enhanced security forces, and in some cases major shifts of particular work. A more safe and secure condition now exists, and more will be done in the near future.

I've covered what is right with the nuclear weapons program, both in the broad sense of its contribution to our deterrent posture and in the details of responding to the President's program to modernize all three legs of the strategic triad, and to improve our nonstrategic nuclear deterrent. The Department of Energy has engaged in a truly cooperative spirit with the DOD to acquire and field these systems and the warheads that arm them.

Now let me discuss what's not right with the nuclear weapons program. The quality is superb, as I'm sure you know, and production requirements are being met. [Deleted.]

[Deleted.] And finally, I am concerned about a congeries of factors which divert the attention of the program away from its core activities.

At first glance, the defense programs budget outlays seem to have recovered from the chronic underfunding at the period of the 1970's. With the support of this committee, the total funding has risen from $3,187.3 million in FY 1981 to $6,826.6 million in FY 1985, which corresponds to about 78% real growth. A substantial part of this growth, however, has been needed to support the requirements of production for the absolutely essential stockpile modernization program. The program is supporting, at significantly increased levels, activities such as safeguards, security, and environmental protection, also required because of changing requirements and underfunding in the past. Such activities, while important, divert both manpower and resources from the primary mission of the program. General Hoover and General Withers can amplify at length about these "taxes", real and figurative, on the program. The net effect has been too little growth, compared to the need, in effort devoted to the cutting edge of the technology in the RD&T program.

In the area of RD&T, there are two things which drive the need for resources: (1) our own needs for advanced development for future systems, which are formidable, and (2) [deleted]. Let me talk first about our own R&D needs.

In the area of strategic forces, one of the major challenges confronting the U.S. defense and nuclear weapons communities is the fact that [deleted]. I can discuss them in two classes.

[Deleted.]

Obviously, the interests of deterrence are best served when [deleted]. Rather, we must be able, in a retaliatory second strike, to destroy those assets which remain to him, and which he would like to count on, in his view, to pursue the war. [Deleted.] But, it is a problem which the services, DNA, and DOE must work and are working.

One of the more promising approaches [deleted].

[Deleted.] We are investigating the feasibility of a small mobile missile. You will recall that the President's Commission on Strategic Forces recommended that engineering design should be initiated to permit deployment of such a missile beginning in the early 1990's. The wide area mobile-based version will present the design laboratories with a new challenge. Such a system would require additional safety, security, and command and control features beyond those essential on silo-based systems. In order to accommodate such features and [deleted].

Another important element [deleted] is the development of a better understanding of the kill phenomenology itself. Here the defense nuclear agency has an active program which is designed to define such effects as [deleted].

The need to understand better the effects of nuclear explosions is becoming more crucial [deleted] and lethal mechanisms has become increasingly important. The responsibilities of Defense Nuclear Agency in these areas, as well as directed effects lethality for SDI, are more crucial than ever; and the DOE laboratories, as well, must contribute to the work. This is an integral part of the DOE R&D activity.

Replacement of the [deleted]. The warhead for this missile will have modern detonation and fire safety features [deleted].

With respect to RD&T pertaining to theater nuclear forces, the political realities in NATO and the related need to modernize our conventional forces will mean that modernization of our nuclear forces will not move as rapidly as those of us would

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like who are familiar with its obsolescence. Instead, our strategy must be to proceed with modernization where we can—principally to continue with the nuclear artillery developments (albeit at lower total build levels) [deleted]—and to put greater effort into providing increased survivability for the smaller number of older systems that we will have, so that their overall deterrent quality is enhanced. This survivability work will also draw heavily on DOE R&D resources—principally at Sandia—so that in this area of TNF, as well as for strategic systems, there will be a net need for increased RD&T.

In the near term, we are hopeful that the Congress will support the modernization plan recently submitted to Congress for the artillery-fired atomic projectiles (W82/W79). As indicated in the May 1984 DOD report on the nuclear posture of NATO and numerous subsequent interactions, our existing 155mm and 8-inch rounds [deleted]. The development of an improved 155mm warhead in conjunction with the improved 8-inch warhead in production, if funded to completion, will result in rounds which can be deployed in NATO Europe with [deleted] increased military effectiveness, thereby markedly strengthening the deterrence contribution of the short-range nuclear posture.

The DOE and DOD plan to produce a mix of modernized AFAP not to exceed 925. The planned build will produce a mix of [deleted] warheads. Production past October 1984 of warheads of both types will be [deleted]. Both projectiles will have improved safety, security, range and survivability over current AFAPs (W33 8-inch and W48 155mm). The total DOE production funds estimated to be expended for both warheads from 19 October 1984 is in accordance with the $1.1b spending limit for production. Stockpile surveillance and maintenance costs associated with these two artillery programs are on the order of $32m per year over the life of the systems involved. Anticipated fielding date of the W82 will be approximately [deleted] assuming funds are appropriated to the level authorized. The planned production of the W79 will be completed in [deleted].

Replacement of obsolete AFAP now in Europe with improved warheads will be carried out within the nuclear stockpile limits agreed to by NATO Defense Ministers at Montebello in October 1983 and SACEUR's implementing requirement study that will be available next month. [Deleted.]

Over the longer term, development of [deleted]. These systems will also need features which contribute to greatly enhanced survivability, including features in the warhead itself. This emphasis is driven by both the Montebello decision to reduce the nuclear weapon stockpile in NATO and the [deleted] the stockpile.

Thus, over the next decade a major new thrust in theater nuclear force-related RD&T will be in the area of survivability, security, and command/control (s^2c). DOE contributes to this in two ways: with safety, security, and control features built into the weapons themselves, and by helping to develop, with the services and the Defense Nuclear Agency, security and survivability features for weapon storage and transport facilities. [Deleted]. All of which contributes substantially to survivability and crisis stability.

[Deleted.] Additionally, B61 bombs with enhanced safety features will replace older navy B43's and B57's. These are examples of what we're already doing. We'll have to do more and better in the future.

Beyond what's in weapons themselves, we must revise [deleted] through the NATO senior level weapons protection group, which I chair, we are laying the groundwork for [deleted]. One of the most important areas of mutual cooperation and teamwork between DOD and DOE is the invaluable assistance to the DOD and the services in developing new concepts for nuclear weapons safety, security, and survivability.

The technology base resident in the DOE laboratories contributes to our national defense in many ways besides nuclear weapon design and support for warhead production. The Department of Energy laboratories are a unique source and pool of the Nation's technical expertise, which supports the overall national defense infrastructure in useful but often not very visible ways. They have the world's most sophisticated computers and a tremendous pool of highly trained and motivated people. This national resource should be used in the broadest ways we can manage, not exclusively nuclear oriented. Closer interactions with the DOD can draw the theoretical knowledge from the laboratories to many practical applications. The expansion of the technology efforts into the nonnuclear defense area, of course, complements and strengthens efforts to modernize the TNF. Deterrence is best served if both the conventional and nuclear weapons areas are a credible threat to our adversary.

In this regard a memorandum of understanding between the DOD and DOE has been signed to conduct a cooperative program of research and development intended to bring about major improvements in nonnuclear munitions technology. The DOD

and the DOE intend to fund jointly and support a stable level of effort at the DOE weapons laboratories on applied research and development of mutual interest. In FY 1985 the DOD is supporting this program with $5 million, with expectation of at least $9 million in FY 1986. Most of the work under this agreement will be of a basic, general purpose and long-term nature covering such areas as experimental development of explosives, advanced fusing, advanced armors and terminal ballistics. I firmly believe that our interest in expanding the R&D areas of the national laboratories in no way modifies their national security mission of nuclear weapons R&D. It will take greater advantage of their existing capabilities. The skills and knowledge acquired through research on nuclear weapons can be exploited to advance the technology of non-nuclear alternatives, and we are asking that congress work with us to accomplish this goal.

In the area of non-strategic fleet weapons, the [deleted]. The contrast between the Soviet and U.S. postures is more pronounced in this area than in any other category of the nuclear balance. Nuclear capability is clearly a major—perhaps the dominant—consideration in the Soviets' view of the maritime correlation of forces. In contrast, those nuclear weapons which we currently have deployed—with the exception of TLAM/N, which was introduced to the fleet last year—average over 23 years in age. [Deleted.] With a significant gap between these two ends of the spectrum.

We have begun to redress this situation, including a reassessment of the importance of this capability, in the past few years. The intention is [deleted]. We had neglected this area for so long that redressing the situation required not only a set of programs, but also reestablishing a whole infrastructure to deal with fleet nuclear problems. There was a somewhat halting start in the early 1980's, but I believe the Navy is now firmly committed to this modernization. As evidence, among many other actions, the Chief of Naval Operations has recently initiated a program within all sections of the Navy, which addresses the importance of being prepared to fight and survive at sea in a nuclear environment. He has personally appeared in three "special CNO film reports" (Nuclear Warfare at Sea, Nuclear Effects at Sea, Nuclear Defense at Sea) which were shown to all sea service members, and has directed that TNW be included as a part of future war gaming and fleet exercises. This is only one of a number of activities. His leadership, by example and direction, has now built the foundation for what I perceive to be a long-term Navy commitment to modernizing its current tactical nuclear capabilities.

As a result of this growing commitment, replacement nuclear systems are being developed [deleted]. The SM2/N, a replacement for the Terrier Sam, which has been operational for 23 years, is supported by this year's DOE budget request with a projected initial operational capability (IOC) in [deleted] in addition, the submarine launched ASW standoff weapon (ASW-SOW), a replacement for Subroc, which was introduced to the fleet in 1964, is supported in the out years of this budget request with a projected IOC of [deleted] and the Navy is currently working on a [deleted]. All of these systems will require significant R&D. One example of an as-yet-unrealized potential in this area is the use of [deleted].

In March 1983, President Reagan took the first important step toward what could be a new and better way to deter war, strengthen stability, and ensure peace—by moving away from exclusive dependence on nuclear retaliation toward greater reliance on defensive systems. To that end, he directed the establishment of a comprehensive and intensive research program, the Strategic Defense Initiative (SDI). The SDI is a research program to vigorously pursue new technologies in order to determine whether we can create an effective defense against ballistic missiles which would strengthen deterrence, increase our security and that of our allies, and thus reduce the risk of war. With results of this research, a future President and Congress could make an informed decision on whether to enter systems development. This research program is based on a multi-tiered ballistic missile defense concept with research concentrated into five key technology areas: directed energy weapons; kinetic energy weapons; sensors; battle management and command, control and communication systems; and supporting technologies.

In the spring of 1984, the Strategic Defense Initiative Organization (SDIO) was established to manage this program. The SDIO provides central planning for the entire effort and uses centers of technical and management excellence within the services, DOD, DOE, and other non-DOD agencies for decentralized execution of research efforts. Although funded separately, the DOE program is integral to the overall SDI program with specific importance in the directed energy as well as the survivability, lethality, and supporting subsystem technical areas. In addition, with DOD funding, the DOE laboratories are important contributors to several of the SDIO nonnuclear development programs.

A memorandum of agreement (MOA) between DOD and DOE was approved in July 1984 establishing an SDI DOD/DOE steering committee comprised of the Deputy Secretary of Energy, the DOD Director of the Strategic Defense Initiative Organization (SDIO), and the Chairman of the Military Liaison Committee (MLC). This steering committee provides DOD program coordination and integration, and a mechanism to resolve issues.

[Deleted] represent the area of primary involvement between DOE and DOD. The DOE has complete responsibility for nuclear source development [deleted]. The DOD will continue to assume primary responsibility for developing acquisition, tracking, and pointing and other development efforts required in conjunction with this program. Close coordination of all elements of this joint program will be effected through special coordinating groups with representatives from DOD and DOE.

The SDI is a program of vigorous research focused on advanced defensive technologies with the aim of finding ways to provide a better basis for deterring aggression, strengthening stability, and increasing the security of the United States and our allies. As a broad research program, the SDI is not based on any single or preconceived notion of what an effective defense system would look like. While the long-term goal of the research program is a truly effective nonnuclear defense, there are a variety of reasons for including nuclear research at this time.

For example, we must be particularly concerned about [deleted] third generation nuclear weapons, which would use the energy released by a nuclear explosion in much more discriminating and effective ways. The change could be greater than that caused by the second generation transition from fission to thermonuclear devices. [Deleted.] Although we believe nonnuclear systems would be more consistent with our long-term policy objectives for strategic defense, we need to enhance our nuclear R&D effort [deleted]. The Fletcher study said of the x-ray laser:

"It is important [deleted]

As will be discussed immediately below, [deleted].

All these needs taken together—the need to [deleted]. Either in terms of manpower or modern facilities, but beyond these identifiable areas of activity, there is another concern which stresses the RD&T program.

I have referred several times so far to concerns about [deleted]. I'd like to elaborate on that, because it is central to two of my concerns about our program—our reduced level of effort in RD&T (which I have already discussed) and our lack of [deleted] (which I will discuss later).

We know that [deleted].

[Deleted.]

In my view, we have here a recipe [deleted].

[Deleted.] Perhaps the only way we can insure against this danger is by a much more vigorous RD&T program—one in which there is room to explore the technology beyond stated or understood "requirements." It has been at least a decade since there was this latitude, although it was a major feature of the U.S. nuclear weapon program until about 1970.

Let me amplify on this [deleted].

[Deleted.]

The President's hope, I believe, is that eventually both we and the Soviets will move to a defense-dominated, instead of an offense/retaliation-dominated, strategic relationship, and that that situation will provide both more stable deterrence and the possibility, eventually, of relying on something other than threat of retaliation for our safety. But until then (which in this context may mean many years), the path to that new strategic relationship will be through a continuing technological competition, moderated and shaped partly by arms control. During that still-competitive phase, the U.S. cannot afford to be less than competitive in any of the major areas of technology, especially not in an area that may have such leverage on defense capability as nuclear directed energy weapons.

Let me turn now to an area where [deleted].

[Deleted.]

On our part, national policy has been clear regarding special nuclear materials for nuclear weapons—such materials should not be the limiting factor in determining the nuclear force structure, and a [deleted].

We are working closely with DOE to assure that DOD requirements approved in the annual nuclear weapons stockpile memorandum are achieved [deleted].

The facilities in which DOE produces the Nation's special nuclear materials are [deleted].

The likelihood of Soviet initiatives or surges in weapons systems in the farther future is [deleted] in virtually all areas of defense industry, the gigantic civil industrial base of the United States provides a backlog of capability to counter possible

Soviet military production surges, and thus helps to deter such surges. The same thing is true for the industrial base for our nuclear deterrent—the U.S. aerospace industry provides a surge capability—with the sole exception, I believe, of the one element that the Federal Government, by law, must provide—capacity to produce special nuclear materials for defense purposes [deleted].

I believe we are most likely to achieve deep and balanced reductions in nuclear forces if the Soviets are convinced that we are in a position to deny them any advantage from further arms build-up. [Deleted.]

[Deleted.]

In 1964, thirteen reactors were producing plutonium and tritium for weapons program. Today there are four operating production reactors, three at Savannah River, South Carolina (P, K, and C), and one, the N reactor at Richland, Washington. Besides tritium, the three Savannah River reactors are producing 3% PU-240 material which is being used for blending.

Start-up of the Savannah River L reactor was scheduled for October 1983, but it has been delayed as a result of court actions on environmental issues. [Deleted.]

[Deleted.]

For the long term, a new source of tritium will be required. The Savannah River production reactors were built in the early 1950's and are undergoing refurbishment to prolong their operating life into the 1990's. However, continued production and processing of tritium is necessary just to maintain the supply needed for the stockpile. Stoppage of tritium production for extended periods would severely degrade the stockpile. A new production facility on line by the mid-1990's to produce tritium is essential.

With regard to uranium, we have seen the amount of oralloy (uranium enriched to 93.15% in the isotope U^{235}) available to the weapons program [deleted].

[Deleted] acknowledgement now of a commitment to support such a funding request would allow prudent and responsible management of such a program, and might provide additional economies by allowing, for example, early commitments for the large quantity of electric energy necessary to support such an enrichment program. [Deleted.]

Production/Stockpile

The nuclear weapons stockpile exists only to support deterrence, and it is difficult to quantify deterrence—some combination of force levels, threat, perceptions, intentions, capability. Because of this, there is no "formula" for arriving at levels for the number of weapons. Fundamentally, it will always remain a subjective, long-term judgment.

Our requirements for nuclear weapons, which are prepared jointly with the Department of Energy and forwarded annually in the nuclear weapons stockpile memorandum to the President for his approval, are based upon inputs from the CINC's and tied closely to approved programs for nuclear weapons delivery systems. These systems are typically high visibility procurements which receive high-level attention both within the administration and the Congress. The force levels finally arrived at reflect a compromise between the contending factors of the threat, required target coverage, support of deployed forces, survivability, support of allies, procurement cost, and life cycle cost. For nuclear-only systems, the cost of the nuclear warhead is typically only a small fraction of the total system cost.

For some dual capable systems, such as artillery and tactical bombs, the situation is somewhat different and the nuclear weapon procurement is not closely tied to the weapon delivery system procurement. Nonetheless, in arriving at numerical requirements, similar compromises are made between the contending factors described above. However, in the case of these dual capable systems, it is difficult to ascribe a cost to the nuclear portion of the dual capable delivery system. As a consequence, some are tempted to argue that these nuclear weapons are regarded by the services as "free" and not subject to the same degree of detailed justification as the dedicated nuclear systems. This is not true—any nuclear weapons system involves a significant degree of cost, both dollar and manpower, to the using service and the decision to obtain or maintain that capability is taken with careful deliberation. But beyond that, the bulk of these dual-capable systems have, for several years, received careful scrutiny in the NATO political context to be certain that we have the minimum essential number. This was underway long before the Montebello decision, and when SACEUR makes his report next month, it will lead the way to further reductions. With the numbers receiving such careful attention, the remaining issue is one of the need for modernization; the stockpile for these dual-capable systems is unquestionably obsolete.

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I have not dealt in detail here with our requests for production of individual weapons, because those requests are covered by representatives of the services. From the point of view of the overall production, while the DOE budget requests represent what is needed to support DOD's stated requirements I remain concerned that the production facilities remain somewhat marginal in regard to restoration and lack of redundancy. However, good progress has been made with the very welcome and gratifying support of this committee and, while the restoration program needs to be sustained, I believe that the corner has been turned. My areas of strong concern then, are with regard to the other two main components of the program—RD&T and nuclear materials.

I'd like to turn briefly, now, to a third area of concern, in addition to RD&T effort and SNM capacity: because of several elements in this climate of the past decade, the attention of the DOE weapon program has been diverted from its primary functions. The weapon program has gone through periods of being an orphan within the Federal Government, with two new sets of adoptive parents during the last decade. During each adoption, both the parents and child have spent a lot of effort becoming acquainted. Further, at least once, when there was consideration of merging DOE with the Department of Commerce, much the same sort of activity had to be endured by the program. The recent issue raised by Senators Nunn and Warner, which resulted in the amendment by Senator Domenici directing a study on funding for the program, has caused similar concerns. Between the requirements of developing a new constituency in its new home, preparing for possible moves to other foster homes, and providing oversight of the necessary, but diverting, responsibilities in the areas of safeguards and security and environmental protection, the attention of many within the program has been spread too thin, away from its primary role. I believe it is a testimony to the dedication and competence of the people involved that the quality of the product for the Nation has remained good; but there must have been an impact—something we would have had for the Nation's defense that we don't have today. My point in raising this with you is simply to add another dimension to the importance that attaches to this committee's continuing support of the program.

Conclusion

Let me summarize by saying that the DOE program has responded heroically [deleted.] In the area of RD&T within the present funding and manpower constraints, I believe the DOE cannot do justice to both the base nuclear weapons program and SDI, and both are essential [deleted]. Finally, the nuclear weapons program has had many distractions to deal with, which make it doubly important to fully support the program.

This year's DOE budget request, if fully successful, is barely adequate to support the nuclear weapons program, and thus deserves this committee's fullest support. Because of these problems, I believe we must look farther in the future. There are many considerations, but let me narrow down to two concrete items.

In the area of research and development, the DOD/DOE long range resource planning group (Starbird study) recommended, in 1980, a fifteen-percent increase in manpower, from 7,400 in 1980 to 8,500. Progress in achieving this objective is continuing, reaching 8,150 in 1985, and planned to reach 8,400 in 1986. However, the Starbird study did not anticipate the inception of a new program, the President's Strategic Defense Initiative (SDI), in which the Department of Energy has a significant role which constitutes an unforeseen expansion of its ongoing responsibilities. In order for DOE to support this essential activity, the level of effort in the core program has actually decreased in the last few years; this loss directly impacts the DOD by reducing development activities for our future weapon systems. Therefore, I feel that the Starbird study manpower goal of 8,500, to be consistent with the initiation of SDI, should be increased substantially, perhaps to around 9,500 in order to maintain proper attention to the core program. I might note that, for comparison, since the late 1970's, the increase in the corresponding DOD nuclear weapon RDT&E has been nearly twice the increase in the DOE defense programs RD&T. Finally, I believe that, to begin to build a resilient position for plutonium and tritium production, an isotope separation capability must be put in place as soon as possible.

That concludes my formal testimony. The military liaison committee members, representing their military departments and I would be happy to answer questions.

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PREPARED STATEMENT BY THE DEPARTMENT OF THE ARMY

Mr. Chairman, members of the subcommittee: I would like to report on the status of modernization of the nuclear artillery projectiles. For some years we have been working to replace the obsolete W33 8-inch artillery-fired atomic projectile (AFAP) with the new W79 and the obsolete W48 155mm AFAPS with the W82. The W82 development program was stopped by Congress 18 months ago, but an agreement allowing resumption was worked out last summer. This legislation was introduced by Senator Johnston and supported by Senator Nunn.

The key provisions and conditions established for the 155mm nuclear program are shown here.

SEC. 1635 DOD AUTHORIZATION ACT, 1985 (PL 98-525, 19 OCT. 1984)

"AUTHORIZATION FOR PRODUCTION OF THE 155MM ARTILLERY-FIRED ATOMIC PROJECTILE"

$50m authorized for DOE facility construction.

Total W79 and W82 may not exceed 925.

Total DOE production funds after 19 Oct. 1984 may not exceed $1.1B for both AFAP.

AFAP must be produced non-er after 19 Oct. 1984.

SECDEF must submit a plan to Congress to implement.

Restart of the 155mm nuclear program was linked to the 8-inch, W79, that is now in production. With the assistance of DOE, OSD, and the Joint Staff, the Army conducted an analysis of options available under this legislation. The critical need for a modernized 155mm nuclear projectile was reaffirmed and a program recommendation was made to the Secretary of Defense. On 4 February 1985, Secretary Weinberger approved the plan and the next day it was delivered to Congress as required.

This slide shows the highlights of the plan and outlines our current AFAP modernization direction.

SECRETARY OF DEFENSE PLAN TO CONGRESS

DOD and DOE will produce 925 modernized nuclear projectiles [deleted].

[Deleted.]

DOE production funds will be within $1.1B limit [deleted].

Note that this is a joint DOD and DOE plan. Given the conditions imposed by section 1635 of the law, it was determined that a mix of [deleted] projectiles makes the best use of the previous investment in the W79 program while simultaneously providing a reasonable program for DOE to adequately establish W82 production capability.

A mix of 155mm and 8-inch nuclear projectiles will permit use of the large numbers of 155mm howitzer tubes, thus enhancing survivability and optimizing deterrence.

[Deleted] after General Rogers submits his nuclear requirements this spring, JCS, with service input, will reassess our ability to meet worldwide nuclear artillery requirements.

I would like to briefly review the need for a modernized 155mm nuclear projectile.

W48 STATUS

[Deleted.]

This slide shows the trend in the balance of delivery systems and warheads in Europe. It also depicts the consequences of no 155mm nuclear capability.

SHORT-RANGE NUCLEAR FORCES IN NATO/WP

Today we are outnumbered in both delivery systems and warheads by the Warsaw Pact. The NATO disadvantage in nonstrategic nuclear forces is projected to continue to grow because of Soviet/Warsaw Pact expansion and modernization. If the 155mm nuclear projectile is not replaced, note the overwhelming superiority the Warsaw Pact will have by 1990.

The FY86 DOD budget request includes $19.6m for continued RDT&E on the W82. The DOE budget seeks appropriation of $15m, authorized last year, to begin facility construction. This appropriation is critical to fielding the W82 in [deleted]. An additional request of $10m to complete the DOE facilities will be made in FY87.

Let me now cover the 8-inch AFAP, the W79. The W79 is currently in production. To date approximately [deleted].

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DOD acquisition cost for this projectile is complete. Active U.S. Army and USMC unit certification is also complete. Here again we don't know our total requirements until SACEUR requirements are received. [Deleted.]

PREPARED STATEMENT BY THE DEPARTMENT OF THE NAVY

Mr. Chairman, gentlemen: The Department of Energy budget, under consideration by this subcommittee, supports navy requirements in strategic and non-strategic warfare. The Navy strategic warhead requirements are dedicated solely to the strategic ballistic missile submarine force. The Navy non-strategic warhead programs support requirements for strike warfare (ashore targets), anti-submarine warfare, anti-air warfare, and Marine Corps battlefield weapons.

Navy non-strategic nuclear warhead requirements will be addressed first.

The Navy has embarked on a program to revitalize our non-strategic nuclear warfare capabilities. This program was initiated in 1980 by the Navy and the Secretary of Defense because the deterrent value of existing navy non-strategic weapons had been eroded significantly by the growing Soviet nuclear threat. An example of this threat to our Navy is evident in the large number of air- and submarine-launched anti-ship cruise missiles in the Soviet nuclear inventory. In spite of this threat, the Navy must meet its global commitments in support of the maritime strategy—the Navy element of national military strategy. The maritime strategy requires that U.S. naval forces operate in forward deployed regions, which includes an ever present uncertainty of nuclear attacks on our fleet by Soviet land-based and at-sea forces. The Navy theater nuclear warfare (TNW) modernization program is designed to remove any incentive for the Soviets to use their nuclear weapons at sea. This program requires hardening our ships and aircraft against the effects of nuclear weapons [deleted]. It requires a comprehensive theater nuclear warfare training program. [Deleted.]

These improvements combine to deter Soviet use of nuclear warfare at sea by raising the level of uncertainty that such attacks would serve their war aims.

It is not Navy policy to buy nuclear weapons automatically as replacements for systems being retired. We require a clear case for the utility of each weapon. Nuclear weapons should not serve as substitutes for conventional weapons where improved conventional weapons will suffice. We will procure only those nuclear weapons which provide a unique and substantial military capability. [Deleted.]

The point is that the Navy nuclear weapons modernization program is well-defined and integrated with the Navy's conventional capability.

One of the most significant developments in the Navy's nuclear weapons capability is the Tomahawk nuclear land attack cruise missile, or TLAM/N. Tomahawk is planned for SSN-637 and SSN-688 class attack submarines; DD-963 and DDG-51 class destroyers; CGN-9, 36, 38 and CG-47 class cruisers; and BB-61 class battleships. These ship and submarine classes will be capable of carrying all Tomahawk variants in any desired mix. TLAM/N will greatly enhance the Navy's deterrence posture by distributing Navy retaliatory striking power across a large number of naval platforms. This will increase the number of Warsaw Pact targets that are put at risk [deleted] Tomahawk complements the power of the carrier air wing and multiplies the effectiveness of the force at sea. TLAM/N will also contribute to the NCA's ability to deter strategic conflict and will provide additional survivable assets [deleted]. TLAM/N reached initial operational capability (IOC) in June, 1984. At present [deleted] Navy ships and submarines are certified to carry TLAM/N. Within the next five years [deleted] TLAM/N missiles will be deployed in [deleted] ships and submarines.

With the exception of the new nuclear Tomahawk cruise missile, the Navy has not deployed a new non-strategic nuclear weapon since 1964. Most of the existing Navy non-strategic nuclear weapons were designed in the 1950's deployed in the early 1960's [deleted].

The DOE budget being considered by this subcommittee also supports development of the W81 warhead for the nuclear version of the standard surface to air missile, SM-2(N). The requirement for this nuclear self-defense missile is very real. [Deleted.]

[Deleted.] The SM-2(N) is a weapon for deterrence and has a unique, well-defined role [deleted] it deters Soviet use of nuclear weapons at sea by increasing the probability that such an attack on the U.S. fleet would fail. The SM-2(N) is needed [deleted].

Another key warfare area is anti-submarine warfare (ASW). Soviet submarine improvements include double hull designs, titanium hull construction, deeper operat-

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ing capabilities, and torpedo countermeasures [deleted]. In order to deal with these faster, quieter, and more survivable Soviet submarines, new ASW weapons are required. An improved conventional torpedo looks promising; however, to prevent the possibility that improvements in Soviet systems could negate, at some point, the capabilities of our conventional ASW weapons, we must have nuclear ASW weapons. The ASW stand-off weapon (ASW SOW), a nuclear-capable submarine-launched rocket, is required to replace Subroc, an aging system [deleted].

[Deleted.]

The Army has a valid requirement for the W79 and W82 warheads to modernize battlefield nuclear artillery. The Marine Corps also deploys with 8-inch and 155mm artillery and must replace its equivalent aging, obsolete stockpile of W33 and W48 warheads. [Deleted]. Artillery-fired atomic projectiles are earmarked for deployment with the Marine Corps. I ask that this subcommittee recognize this important marine requirement when evaluating the DOE budget for production of W79 and W82.

The last Navy non-strategic program to be discussed is the B61 nuclear gravity bomb. The DOE budget supports the continued building of the new B61 mod 3 and mod 4 bombs which contain improved safety and security features. These new bombs will be allocated to the Air Force to modernize their [deleted] bomb stockpile, but the Navy will benefit indirectly from this program. [Deleted.]

Through initiatives in nuclear survivability for our ships and aircraft, nuclear weapons modernization and training, the Navy is providing forces with the potency to deter a nuclear war at sea. The Department of Energy budget, under consideration by this subcommittee, supports navy non-strategic nuclear weapons modernization programs which are essential to the effectiveness of our fleet.

Shifting now to strategic systems, for the Navy this means warhead requirements in support of submarine launched ballistic missiles.

There are nineteen Poseidon C-3 submarines, and each submarine carries sixteen missiles. Each C-3 missile is loaded with [deleted] W68 warheads. The W68 building program is long completed; the last W68 was delivered to the Navy in 1975. DOE is, however, conducting a retrofit program for the W68 because these C-3 missiles will be used in Poseidon submarines through the 1990's. [Deleted] these warheads are being modernized with [deleted] modifications. The FY86 DOE budget request includes funds to continue this retrofit program.

The [deleted] W76 warhead today supports the Trident I (C-4) missile. Twelve Poseidon SSBNS, originally designed to carry the C-3 missile, have been modified to carry sixteen C-4's, each with a payload of [deleted] W76 warheads. The first eight Trident submarines, four of which are now making patrols, will each carry 24 C-4 missiles. [Deleted.]

The Trident II (D-5) missile is now in its second year of full-scale engineering development. DOE is developing the W88 high yield warhead for this missile. With the combination of high accuracy and yield, the D-5 will provide our survivable, seabased strategic force with greatly improved deterrent capability. D-5 will give us the capability to hold at risk the full spectrum of Soviet targets, including those [deleted] which the Soviets value most.

By the year 2000, when all of our older Poseidon submarines will have been retired, the Navy will have an SSBN force of about 20 Trident submarines, all carrying the Trident II D-5 missile. The first eight Tridents will be backfitted with the D-5 systems during overhaul, beginning in the early 1990's.

The Trident II D-5 missile will carry either [deleted] W88 [deleted] warheads or [deleted] W76 warheads. [Deleted.]

[Deleted.]

Before closing, the continuing invulnerability of our ballistic missile submarines must be emphasized. After completing 2,302 strategic deterrent patrols since 1960, [Deleted]. All who are familiar with our security efforts agree with this assessment. The situation is dynamic, and we must continue our vigorous efforts to ensure we remain ahead of the threat. This survivability of our strategic submarines equates to stability in a crisis. Since our SSBN's cannot be attacked successfully, no enemy is likely to initiate aggression when his attack cannot deny our capability to retaliate effectively. DOE's support of the Navy's strategic programs is most important to our Nation's deterrent capability.

Mr. Chairman, this statement has stressed the importance of the many programs which DOE is conducting for the Navy. The Navy's requirements are carefully considered and valid. We have initiated cost reduction measures where military requirements are not compromised. The Navy's nuclear warhead requirements are individually important to Navy missions and collectively support national security. These Navy requirements deserve your strong and continued support.

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PREPARED STATEMENT BY THE DEPARTMENT OF THE AIR FORCE

Mr. Chairman and subcommittee members: We greatly appreciate the opportunity to explain how essential the Department of Energy's efforts are to Air Force modernization programs. The Air Force and the Department of Energy, and its predecessor agencies, have had a close and continuing partnership for almost forty years. While we collaborate on non-nuclear matters, the primary goal of our partnership is to provide safe, secure, and effective nuclear weapons for our strategic and non-strategic nuclear forces. This allows us to support the strategic modernization program, meet our commitments to the allies, and upgrade the overall safety and use control of our weapons stockpile.

NUCLEAR WEAPONS REQUIREMENTS

Support the President's strategic modernization program.
Support NATO's dual track decision.
Improve weapon safety [deleted].

I will describe the nuclear weapons of interest to the Air Force and their status. Department of Energy programs for the Air Force in fiscal year 1986 continue our modernization efforts. These are shown on the slide and are divided into three

FY 86 PROGRAMS FOR THE AIR FORCE

Programs	Purpose
Development	
• SRAM II	COMPLETES STUDY TO ESTABLISH WARHEAD TECHNICAL FEASIBILITY AND COST TRADEOFFS
• SMALL ICBM	
Production	
• B61-3, -4	CONTINUES PRODUCTION TO REPLACE OLDER [DELETED] TACTICAL BOMBS
• W80	CONTINUES PRODUCTION OF WARHEADS FOR ALCM/ACM
• B83	CONTINUES PRODUCTION TO REPLACE OLDER [DELETED] STRATEGIC BOMBS
• W84	CONTINUES PRODUCTION OF WARHEADS FOR GLCM
• W87	CONTINUES INITIAL PRODUCTION OF WARHEADS FOR PEACEKEEPER
Stockpile Improvement	
• B28	CONTINUES [DELETED] MODIFICATION OF A PORTION OF B28 STOCKPILE
• B61-1	CONTINUES [DELETED] MODIFICATION OF ALL OF B61-1 STOCKPILE

Programs in development, SRAM II and small ICBM, are in the study phase to establish technical feasibility and cost tradeoffs of various warhead candidates and features. Programs in production or completing engineering development include B61-3 and -4 tactical bombs, B83 strategic bomb, and warheads for the air- and ground-launched cruise missiles, advanced cruise missile, and Peacekeeper.

The B61-3 and -4 production programs are allowing the Air Force to replace late 1950 and early 1960 vintage tactical bombs with weapons having modern safety and use control features. With these features, the weapons provide increased assurance against unauthorized use and decreased risk of plutonium scatter in all operating locations including high terrorist threat areas. In addition to enhanced safety, the B83 provides improved high speed, low altitude delivery capability against the various hard targets in the strategic target base. Its [deleted] versatility will, over time, allow the Air Force to retire three older bomb types. As the B83 becomes available

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in quantity, the [deleted] will also eliminate the need to move weapons from base to base as assigned targets change.

The two programs in stockpile improvement are the B28 and B61-1. When requirements exist for improved safety and [deleted] in existing weapons, the Air Force, in consultation with the DOE, looks at whether a stockpile improvement or a new weapon provides the best solution. Stockpile improvement was selected for the B61-1 and the B28.

This slide illustrates the FY85 status and the progress in our modernization efforts that will occur from the DOE FY86 budget request.

NUCLEAR WEAPON MODERNIZATION PROGRESS

	END FY 85	END FY 86
• WEAPONS DELIVERIES TO AIR FORCE AS A PERCENT OF INVENTORY OBJECTIVE		
• SAFETY AND SECURITY IMPROVEMENT		
• STRATEGIC BOMBS		
• TACTICAL BOMBS		
• CAPABILITY IMPROVEMENT	[DELETED]	[DELETED]
• PEACEKEEPER		
• ALCM/ACM		
• GLCM		
• W25 (GENIE)	[DELETED]	
• B53	[DELETED]	

In the case of strategic and tactical bombs, the inventory objective is to modernize, not increase, the existing stockpile. This is accomplished both through modification of older bombs and, in some cases, completely replacing the weapon on a one-for-one basis. The Peacekeeper, ALCM/ACM, and GLCM provide new capabilities to counter the increased Soviet threat.

To accomplish these modernization objectives, DOE must produce new weapons as they retire old ones; maintain a healthy research and development program to hedge against continued Soviet military capabilities; and test weapons to insure continued stockpile reliability. This requires an efficient production and reclamation complex, an adequate supply of special nuclear materials, and a vigorous weapons research, development, and test program.

With your past support, we have made progress in our modernization efforts. Your continuing support in fiscal year 1986 and beyond is essential to complete our efforts, and we ask that you favorably consider the Department of Energy budget request.

Senator WARNER. Thank you.

I have asked most of my questions during the progress of this hearing.

Senator Hart, do you have any questions?

Senator HART. Thank you, Mr. Chairman.

Dr. Wagner, why shouldn't the DOE's activities in weapons production be in the Defense Department?

Dr. WAGNER. If you mean in weapons production——

Senator HART. I mean all of the activities.

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Dr. WAGNER. Oh, all of the activities.

Well, I am right at the interface where that question resides.

I should not answer you without pointing out that I spent 18 years at Livermore before I came to DOD and that, perhaps, colors my view.

The people who framed the Atomic Energy Act felt that the technology of nuclear weapons ought to be separated from the Department of Defense simply on kind of categorical grounds—that it is too important to leave to what at that time was the Department's equivalent. There was no Department of Defense; there was a Department of War and a Department of Navy.

I personally still subscribe to that view. I think it is important to have two separate and independent judgments, not only on safety and security, which is very important, but also on many other things which have to do with nuclear technology.

We found, and perhaps the lab directors will amplify on this, over the years that the DOE is able to maintain a continuity in this area, perhaps because they are one step removed from the immediate requirements of building weapon systems and putting them in the field. This keeps the technology base and keeps them exploring things and looking at things that, if they were immersed in the DOD system, I am afraid would gradually be siphoned off to what we viewed as kind of immediate needs.

Senator HART. I understand.

[Deleted.]

Do you agree with those analysts at Livermore and elsewhere who say that one of the ways of correcting that is to ratify the limited test ban treaty?

Dr. WAGNER. Do you mean the comprehensive treaty? The limited test ban treaty is the one that keeps us underground, which has been in effect for many years.

Senator HART. Yes.

Dr. WAGNER. There are the two treaties, the threshhold test ban treaty, which has been signed but not yet ratified, and there is the continuing possibility, which cycles up and down of a comprehensive test ban treaty.

I feel very strongly that the comprehensive test ban treaty is something that would be detrimental to the Nation until we have made sufficient progress in arms control and other arenas that we do not have to depend on the deterrent capability of our own weapons as heavily as we do.

[Deleted.]

I think that we ought to put into place, jointly with the Soviets and by opening discussions with them toward this end, a better way of verifying the threshhold test ban treaty before we lose the little bit of leverage that ratification would give us to bring them to join with us in that activity.

Senator HART. Are we making that effort?

Dr. WAGNER. We proposed it to the Soviets perhaps a year ago or 18 months ago—I have forgotten just how long. There are a couple of different approaches that might be taken, but they refused to participate.

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Senator HART. You said in response, in the first part of your answer, that we should not ratify until we have better arms control or more arms control—the Comprehensive Test Ban Treaty.

But that is arms control.

Dr. WAGNER. Yes.

There are some people who try to make a semantic distinction between arms control and comprehensive test bans. I think that is a disingenuous distinction. Of course it is a part of arms control.

My point is that it is limiting the technology. I do not share the view that the developments in the warhead technology have been some driver of the arms race. I think that it is a much more complex issue and that, in fact, the reliability and quality of our nuclear warheads is so much at the heart of deterrence that, until we need to rely on it less because we have brought the levels of weapons down and we have made the relationship between the force structures on both sides more stable, until we reach that point, we need to maintain the capability to test warheads.

Senator HART. Mr. Chairman, I think right there we have the crux of the arms control problem. Both sides are in a cycle that they cannot break out of. We need improvements, enhancement of our deterrence until we get arms control, but we are not going to get arms control while we both want to continue to improve our deterrence.

Senator WARNER. I think the Senator's observation is well taken.

My concern has been, should the United States and the Soviet Union enter into such a treaty and should the Senate ratify it, then other nations could do the testing and perhaps surreptitiously supply the Soviet Union with information.

Is that a weakness there? Or even other nations could get ahead of us in a certain technology if we preclude the testing and they can become a threat to this country.

Dr. WAGNER. Over a long period of time, Senator, I suppose that could happen.

Senator WARNER. But it is not immediate? You would discount it?

Dr. WAGNER. I don't think that is a central argument. I believe we need the technology.

Senator WARNER. Thank you.

Senator Cohen?

Senator COHEN. [Deleted.]

Dr. WAGNER. [Deleted.]

I am sure they have a lot of respect for what goes on at Livermore, Los Alamos, and Sandia. I tend to believe that that respect is an important part of our deterrent posture and, in fact, is one of the many reasons for keeping the levels of R&D at those labs at a reasonably high level.

Senator COHEN. They seem to have respect, based upon what they know, and we seem to have some fear [deleted].

Dr. WAGNER. [Deleted.]

Senator COHEN. Let me look at [deleted].

I notice, for example, that on page 16 you talk about the need to understand better the effects of nuclear explosions, but not a word was said about the phenomenon known as nuclear winter.

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It seems to me that this ought to be a prime area for investigation by DOE, to see whether or not, if we can, in fact, set this in motion [deleted].

Dr. WAGNER. I would agree with you about the nuclear winter R&D program. In fact DOD and DOE in 1986 are going to add perhaps 50 percent with I think the prospect of a higher level in the outyears to our joint research program in that area.

Senator COHEN. But there is nothing mentioned in this whole report about that. You did not use one word about that phenomenon which is now receiving quite a bit of attention.

Dr. WAGNER. That's true.

The thrust of that particular part of my prepared statement was with regard to R&D on effects that pertain to the characteristics of the warheads themselves.

I would agree with you. I have been supporting strongly, myself, this joint R&D program.

Senator COHEN. It might have a lot to do with our targeting strategy, whether you go into silos, whether you go into cities, whether they have plastics factories and so forth.

Dr. WAGNER. Absolutely.

I agree with you.

Senator COHEN. There is one other thing, and we have a very short time cycle on this.

I notice in the Navy section there is a statement on page 10 that says [deleted].

That is not my understanding [deleted].

Dr. WAGNER. I should perhaps turn this over to Commodore Bacon. But let me say that the distinction, as I understand it [deleted].

Senator COHEN. [Deleted.]

Dr. WAGNER. [Deleted.]

If you like, we can get back to you with more on that.

Did you want to comment on that?

Commodore BACON. I am Commodore Roger Bacon. I would like to comment on that.

[Deleted.]

Senator COHEN. I think we ought to follow that very closely because there is some split within the community as to whether or not we can say that without qualification today.

Commodore BACON. Yes, sir. You are right. It is something that we have to look at for our security program all of the time. It does not stop with today's estimate. We have to continue to look at what the laws of physics would allow and what technology would permit in the future. That is what we are trying to do, sir.

Senator COHEN. Thank you.

Thank you, Mr. Chairman.

Senator HART. May I just ask one factual question?

Senator WARNER. Yes.

Senator HART. Within the defense community, broadly defined, what is the minimum yield test, underground test, that we can verify?

Dr. WAGNER. [Deleted.]

Senator HART. [Deleted.]

Dr. WAGNER. [Deleted.]

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Senator HART. [Deleted.]

Dr. WAGNER. Sure there is.

Senator HART. Between Livermore and Los Alamos.

Dr. WAGNER. There is disagreement among many, many players.

Senator WARNER. Senator Bingaman?

Senator BINGAMAN. Thank you, Mr. Chairman.

Dr. Wagner, let me ask a clarifying question on your comments on the research and development base in the Energy Department Laboratories.

Am I right that, from what you have said or from your basic point of view, when you take out the strategic defense initiative research and the inertial confinement fusion research is it correct to say that we are actually proposing to reduce the level of funding of research and development at our laboratories?

Dr. WAGNER. I think that in 1986, which is the only year that we can see with some precision, it will probably come down slightly. What I am more concerned about, though, is that during the 1970's, that kind of research declined by a factor of two or so, and has increased, including the SDI, by 15 or 20 percent since the bottom. It is really reestablishing that previous level rather than slight adjustments this year or next year that I am concerned about.

Senator BINGAMAN. It is your view, then, that we need to be putting more than you are proposing in this budget into this R&D base?

Dr. WAGNER. I think that the 1986 budget is very tight. What I would like to see established is almost a national level of policy agreement within our entire Government that we ought to strengthen that base over the next few years.

Senator BINGAMAN. Let me ask about inertial confinement fusion.

Last year, the Congress asked the President to set up a high level group, to review this inertial confinement fusion program and to report on what the future of that program should be.

My understanding is that we are supposed to get an interim report this June and a final report next year, in May.

Dr. WAGNER. If I might interrupt, I think you ought to address that question to the DOE Laboratory Directors.

ICF is a step removed from what DOD, which I represent, sees. We see it as part of the overall tech base, and I would prefer not to address that, the ICF.

Senator BINGAMAN. All right.

General Hoover, would you be able to address this?

I am concerned about the administration request that we cut back, I guess from over $150 million to $70 million in that research before we get that report.

Mr. HOOVER. It is a concern, sir.

I will not try to say that the reduced funding level requested is based on any knowledge on our part that the inertial fusion program for some reason is not a good program. Simply stated, it became a matter of budget priority and funding limitations and constraints.

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We concluded that inertial fusion was of a lower priority than other activities we wanted to support in the research and development budget.

There is uncertainty as to what level inertial fusion should be funded at, so we folded it into the research and development line so it would compete with other R&D programs. This way, the national laboratory directors will recommend what actual amount of funding would go into inertial fusion.

Part of the issue is the importance of inertial fusion at each specific laboratory to specific weapons application activities. So the final answer should not be couched in terms of how much each laboratory will actually fund the inertial fusion program.

Senator BINGAMAN. Am I right that the main research is going forward at facilities that have been recently constructed and we really do not have the results of that research at this point, where we are proposing major cuts in the funding? It just does not seem to make sense, based on what I know about research in this area.

Mr. HOOVER. Yes, sir. We do need to collect data on the basis of the facilities that we have recently completed. The question really is at what pace you need to collect that data, what should be the scope of the program.

Senator BINGAMAN. But do you believe the data can be collected at the rate of funding that you propose here?

Mr. HOOVER. As I said, I do not view the $70 million, as a hard, firm line in terms of what will actually be funded in the inertial fusion program. I am waiting for the recommendation of my laboratory directors as to what level of funding they feel should be supported in inertial fusion in comparison with the other priorities that they will have upon them.

Senator BINGAMAN. So you would expect them to add to that $70 million funds from their other research programs in order to do what is necessary in this field?

Mr. HOOVER. I believe that will be a collective judgment, and if they make a recommendation to that effect, and we can determine that it is not impacting other priorities, such as the strategic defense initiative, then it would be acceptable, if they want to add some other research and development funds to that program.

Senator BINGAMAN. Mr. Chairman, my time is up. But I would want to revisit this issue probably when we get further into these hearings.

Let me also, if I may, submit for the record some questions regarding the waste isolation pilot plant, if I could do so.

Senator WARNER. Yes, without objection.

Senator BINGAMAN. Thank you very much.

Senator WARNER. Senator Glenn.

Senator GLENN: Thank you, Mr. Chairman.

Doctor, you note in your testimony that the Soviet Union [deleted].

Do you think that the Soviet Union is capable of [deleted].

Dr. WAGNER. [Deleted.]

Senator GLENN. Do you think they are capable of doing that?

Dr. WAGNER. I think they are capable.

Senator GLENN. I was quite interested in your figures on [deleted].

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Dr. WAGNER. Let me clarify [deleted].

Senator GLENN. That one really disturbed me because, even if [deleted].

Dr. WAGNER. No, I do not. [Deleted.]

Senator GLENN. [Deleted.]

Dr. WAGNER. [Deleted.]

I can answer that for the record, if you wish.

Senator GLENN. I am not trying to pin you down. You can give us the actual figures later on. [Deleted.]

Dr. WAGNER. That, of course, depends on the yield. I think I would prefer to take that question.

Senator GLENN. I was just referring to the yields that you gave right here [deleted].

I am just looking for the impact this would have on that kind of decision.

[The information follows:]

[Deleted.]

Senator GLENN. With regard to the small ICBM, you indicate that we will need a new warhead to support the small ICBM. Is that correct, that we cannot adapt one of our older warheads to the small ICBM?

Dr. WAGNER. It depends on what version of the small ICBM you are talking about.

For some versions that we are looking at, we feel that we might need a capability to be more mobile during peacetime, and in that case, one might want to have the same kind of [deleted].

Senator GLENN. Would the Pershing warhead be useable on this?

Dr. WAGNER. [Deleted.]

Senator GLENN. What is pacing in the mobile project? Would it be the warhead development or the vehicle development? Originally we had some estimates, about 1 year or so ago, that we could have the mobile actually operable before the end of this decade. Now, of course, in the midst of the MX argument, everybody calls up about it and talks about the mid-nineties and so on.

Senator COHEN. What is pacing it is the MX deployment.

[General laughter.]

Senator GLENN. Right.

So, the figures get varied, depending on who wants to argue what at any given time here.

What I was trying to get an idea of is would the warhead be the pacing item or would the other developments be the pacing items?

Dr. WAGNER. It is too early for us to say; but for the variant, which would have to be quite mobile, it might be that it would be the warhead. The safety features on the warhead, in particular, are important.

Senator GLENN. Would you give us an IOC on that?

Dr. WAGNER. I can't today. We are aiming for the [deleted].

Senator GLENN. I have just one other question and then my time will be up.

This special isotope separation facility in the weapons program you mentioned, it would give us a real reserve capacity for plutonium. What do you see the source of that being? Would you intend to use commercial grade?

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Dr. WAGNER. No, sir.

Senator GLENN. Separation, or out of our civilian nuclear program?

Mr. HOOVER. It would not be out of our civilian program.

Dr. WAGNER. It would be out of the weapons program's own plutonium, which is not as pure as it needs to be for producing weapons.

There is another aspect of the isotope separation, if I could take just a minute, which is to make even purer and lower in intrinsic radiation the plutonium that goes into weapons than it is today. This might be a long-term capability that we would want to have. It would take many years to cycle through the stockpile and make it purer.

[Deleted.] Over the long-term I think we would like to clean up the plutonium.

Senator GLENN. Thank you, Mr. Chairman.

[Deleted.]

Senator WARNER. Perhaps the lab directors might wish to address that.

Senator GLENN. Do you have enough money to proceed along that line, full speed ahead?

Dr. WAGNER. Maybe the lab directors ought to address that.

Senator WARNER. They are ready to take this issue and work with it.

Senator Thurmond.

Senator THURMOND. Thank you, Mr. Chairman.

We are very pleased to have you gentlemen with us. This is a most vital subject and is most important to our national defense. I am very interested in it.

General Hoover, what are the options presently under study for a new production reactor or reactors and which sites are under consideration?

Mr. HOOVER. Yes, sir. We have had ongoing studies to look at what I would categorize as a large reactor, and there are three candidate sites that are being considered or studied with regard to the large reactor. Recently, we have concluded that we should expand the base of our study activity to look at smaller reactors, such that you might be able to phase in in an incremental sense a number of smaller reactors over a longer period of time, rather than one reactor all at once.

But no decisions have been taken. This is still very much in the study stage.

Senator THURMOND. Have any of the sites been eliminated from consideration?

Mr. HOOVER. None of the sites have been eliminated from consideration.

Senator THURMOND. Are you at liberty at this time to say which sites are under consideration, or would you prefer not to?

Mr. HOOVER. Well, certainly the sites that have reactor capability today are under consideration, Savannah River, certainly, Richland, WA, and Idaho.

Senator THURMOND. General Hoover, how important is it to maintain quality of materials production sources as opposed to a single production source?

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Mr. HOOVER. Well, I think it deserves consideration from a vulnerability standpoint because of the potential of some catastrophic failure from a natural source, such as a tornado.

My personal view is that we should maintain dual site capabilities.

Senator THURMOND. Is it generally felt, then, that there probably should be several sites in case of a disaster at any one site?

Mr. HOOVER. I would feel a lot more comfortable if we had two or three sites where we had production reactors.

Senator THURMOND. And naturally you are considering several now which have smaller reactors rather than one with a big reactor?

Mr. HOOVER. As I said, we have expanded our study base to look at that approach. We have probably the greater bulk of our data to date on the one large reactor approach to the problem.

Senator THURMOND. And these matters are under study and no final consideration has been made?

Mr. HOOVER. Yes; they are under study, and no final consideration has been made.

Senator THURMOND. Thank you very much.

Mr. HOOVER. Thank you, sir.

Senator THURMOND. Mr. Chairman, a new Attorney General is to be sworn in and I am going to have to attend the ceremony.

I want to thank you gentlemen very much.

Senator WARNER. Thank you.

We have a member who has just joined us, and he will pursue his question period now.

Mr. Wilson.

Senator WILSON. Thank you very much, Mr. Chairman.

I regret that I was unable to attend earlier and I am even more regretful that I must make a real hit-and-run appearance.

I did want simply to make the statement that over the last couple of years, I have had the opportunity to become more acquainted with the work of the national laboratories, and I think it is of the greatest importance. It is no exaggeration whatever to describe them as a great national asset, both to our national security and otherwise.

I am very pleased, as an alumnus of the University of California, that the connection exists between the labs and the university.

It is my intention, as a new member of this subcommittee, to take an even more active interest in their work, and considering what is on the plate for this committee and this subcommittee in our concern with the strategic defense initiative, weapons testing, and verification procedures, we will be keenly concerned with the ability that the labs have to perform the work that has been assigned them in the national security interest.

I have a single question that I would like to put into the record, which I would ask Dr. Batzel.

The real question is what your opinion is as to the fiscal year 1986 funding for the facility at Livermore. You were kind enough when I was there, some 18 months or so ago, to give me an opportunity to have exposure, as the Nova facility then existed. I have a concern as to whether or not it is adequately funded, and would offer this opportunity for you to give your opinion on that subject.

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Dr. BATZEL. The Nova facility has just been completed. It came in under cost and met our budget, as expected, and on time.

The facility dedication we hope will be right after the first of April.

The dollars available to the ICF will not support optimum use of that facility. In fact, my plan would be to supplement the dollars at least at this stage of the game that I see as available from ICF funding, supplement it from weapons research, and development, and testing in order to run a minimum program on that facility and operate it.

Senator WILSON. Mr. Chairman, I regret that I am required to be at three different places at the same time.

Senator WARNER. Thank you very much, Senator, for joining us.

Gentlemen, we will now conclude with panel two and we will hear from our laboratory directors.

We thank you all very much. We may have further questions for the first panel.

If you would be kind enough to secure this room once again, I would appreciate it.

[Pause.]

I am informed by counsel that the room is now properly secured and that all persons who are present are accounted for and entitled to be present.

Gentlemen, far be it from me to suggest amongst you three titans who should proceed first. So I will leave it to you to decide how you wish to proceed.

STATEMENT OF DR. ROGER E. BATZEL, DIRECTOR, LAWRENCE LIVERMORE NATIONAL LABORATORY

Dr. BATZEL. Mr. Chairman, I think I will go first.

Mr. Chairman and members of the subcommittee, I am pleased to be here again.

What I want to do is restate our commitment to nuclear weapons research and development at the Laboratory and then to place into context some of the questions, at least as we see them from the Laboratory, in terms of the blue ribbon task group.

I will spend a minute on the figures and will talk about our efforts related to SDI [deleted]. Then, finally, I will give a statement about the special isotope separation technology status.

[Chart deleted.]

The nuclear weapons programs underway at the laboratory at this stage are listed on the Vu-Graph. There are five different systems, with two already in the stockpile. The warhead for MX, the W87, has an IOC date of December 1986.

[Deleted.]

[Chart deleted.]

Let us blow it up here so you can see what it looks like.

[Deleted.]

Senator WARNER. [Deleted.]

Dr. BATZEL. [Deleted.]

Senator WARNER. [Deleted.]

Dr. BATZEL. [Deleted.]

Senator WARNER. [Deleted.]

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Dr. BATZEL. [Deleted.]

BLUE RIBBON TASK GROUP

Now, with respect to the Blue Ribbon Task Group, we have had our first meeting of the task group. One of the issues which I wanted to stress was the fact that the weapons laboratories—ourselves, Los Alamos, and Sandia—have a special place in the defense community. We have, as a consequence of our relationships with the Department of Energy and with our sponsors, a position in which we are able to provide what we hope are objective, independent views.

[Chart deleted.]

Prof. Charles Townes, Chairman of the MX Basing Panel, in 1983 wrote a letter to President Saxon, then president of the University of California, with the words that you see. Those words could apply equally to Sandia or Los Alamos.

Senator WARNER. I will interrupt to say that the recorder will take a copy of this quotation and insert it into the record.

[The information follows:]

LETTER: Dr. Charles M. Townes to Dr. David S. Saxon

". . . It was clear that most of the industrial organizations were quite cautious about giving information or making conclusions which would be contrary to Pentagon policy. I was personally impressed that the many persons who helped us from Livermore seemed completely objective in examining the technical facts, in investigating whatever needed to be looked into, in looking for weaknesses as well as strengths in current proposals, and in being willing to state plainly, though diplomatically, where they did not agree. In most cases, I found individuals from academia also objective, though generally by no means so deeply knowledgeable . . ."

". . . I make the above point because I think that, contrary to some opinions, Laboratory personnel are often important in giving helpful perspective and ameliorating U.S. nuclear policy, and that this is partly because they are protected by the management structure from obvious pressures to which commercial companies or governmental laboratories are subjected . . ."

Dated February 11, 1983

Dr. BATZEL. It is the issue of having people who can give objective evaluations of technical matters without the worry of pressure to change a technical view.

So my position is that it is important to protect for the country this kind of situation. How that is done is something we can talk about, that is, how the existing situation works. The existing situa-

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tion works, it works well. And since it works, I am reluctant to fix it.

The other issue I wanted to talk about was the work we are doing in support of SDI.

[Chart deleted.]

NUCLEAR-DIRECTED ENERGY

The laboratory has been working on directed energy concepts for a period of roughly 10 years. In fact, it predates the SDI option in its own right.

I discussed with the committee last year the status of our nuclear driven X-ray laser. [Deleted.]

The configuration of the nuclear driven X-ray laser is shown on the next slide.

[Chart deleted.]

[Deleted.]

[Chart deleted.]

[Deleted.]

So, the potential in this kind of technology is very significant. It is a new area, an area which is idea-rich, one we have begun to work, but we need to work more.

[Deleted.]

[Chart deleted.]

[Deleted.]

Senator WARNER. [Deleted.]

Dr. BATZEL. [Deleted.]

Senator WARNER. [Deleted.]

Dr. BATZEL. [Deleted.]

Now I want to switch gears completely.

Senator WARNER. Before we switch off that track, we still have funding this year. I read some reports where policy decisions are being made not to emphasize quite as much research and development effort on this type of technology, the desire to get the nonnuclear.

Where are you in this equation? Have we put in enough?

Dr. BATZEL. [Deleted.]

I have the same concern about making sure we understand this technology in a timely way. It is important.

Senator WARNER. I do not want to take up too much time, but how would such a system be deployed?

Let's start with that question.

Dr. BATZEL. All right.

[Chart deleted.]

[Deleted.]

Senator WARNER. [Deleted.]

Dr. BATZEL. [Deleted.]

Senator WARNER. [Deleted.]

Dr. BATZEL. [Deleted.]

Senator WARNER. [Deleted.]

Dr. BATZEL. [Deleted.]

Senator WARNER. [Deleted.]

Dr. BATZEL. [Deleted.]

Senator WARNER. [Deleted.]

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Dr. BATZEL. [Deleted.]
Senator WARNER. [Deleted.]
Senator BINGAMAN. [Deleted.]
Dr. BATZEL. [Deleted.]
Senator WARNER. [Deleted.]
Dr. BATZEL. [Deleted.]
Senator WARNER. [Deleted.]
Dr. BATZEL. [Deleted.]
[General laughter.]
[Deleted.]
Senator WARNER. [Deleted.]
Dr. BATZEL. [Deleted.]

I think I have already made the point about the Nova facility, so I will not cover that.

SPECIAL ISOTOPE SEPARATION

My final comment has to do with the fact that from the point of view of special isotope separation, that technology is ready to go. We have demonstrated it, so we are ready to proceed with that particular technology. It makes sense in my mind for the reasons which Dr. Wagner and General Hoover have stated that the United States ought to have such a facility.

Thank you, Mr. Chairman.

Senator WARNER. Thank you, Dr. Batzel.

Who will be next?

STATEMENT OF DR. DONALD M. KERR, DIRECTOR, LOS ALAMOS NATIONAL LABORATORY

Dr. KERR. Mr. Chairman and members of the committee, thank you for the privilege of appearing here today.

BLUE RIBBON TASK GROUP

I thought I would begin by talking a little about the Blue Ribbon Task Group which some of us have called the Nunn-Warner Committee, for good reason, and about some of the thoughts that we in the laboratories have tried to convey to that panel as they have undertaken to try to address your questions.

In particular, one of the things that I tried to make very clear was that the laboratories, in fact, are very special assets because there are really three main points that I think we should try to keep in mind.

The first is their people. They are collections of some of the best scientists and engineers in this country. In the case of Los Alamos, it is something over 7,500 people. Sandia is a bit larger with its two locations. Livermore is in between, I think, at the present time.

But in all three cases you have facilities where there is something on the order of 3,000 professional employees, who are supported very well in several different ways, not only the one that you are so conscious of which are the resources that we need.

A very important point is that there are special facilities in all three laboratories that are unique in this country and in some cases unmatched anywhere in the world. That is a very important set of assets as well.

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I think the third, and perhaps most ephemeral but almost most important point, is that all three laboratories and this program have been challenged over the years to really do the leading edge work in the various areas of science and technology. They have done so in a framework where they have been able to respond.

So, when addressing those questions that you raised last year in the authorization bill, we have tried to start from that base and say how is it we have worked in the past, how are we working today.

LOS ALAMOS NATIONAL SECURITY PROGRAMS

In the area of what are we doing today, there are really four main things that I would like to try to cover.

Our program at Los Alamos really has four components in what we call our national security area. The first of them is strategic and theater nuclear force modernization. In fact, that has been the largest effort and the longest continuing effort.

So far in the 1980's, we have provided the warheads for the Trident system, both Trident I and we are now looking at Trident II, for Minuteman III with the Mark 12A, and the air launched and submarine launched cruise missiles, as well as the Pershing II now being deployed in Europe.

That workload has been substantial and continues with the Trident II, which I mentioned, the advanced cruise missile assignment, and the standoff ASW system that we are developing for the Navy.

It is often forgotten, however, in the rush to discuss SDI, both its policy as well as its technical implications and some of the other matters that concern us, but I need to make the point that it is the base from which we do other things.

The second area is the strategic defense area where you know, from your visits, Mr. Chairman, to the laboratory, we work not only on nuclear driven ideas, such as my colleague, Roger Batzel, just talked about, but a whole range of things from neutral particle beams to laser techniques to the various kinetic energy ideas, that we share with others the responsibility for working on. We are not proponents for any particular approach because, quite honestly, the state of maturity in those technologies is such that we cannot tell you at this point even if they are technically feasible thus far, whether they are economically feasible or, in fact, address a real military capability this country needs for the future.

So, we are addressing the range of weapons concepts.

We are also looking at what those capabilities might mean either in large deployments or small ones, so-called thin ballistic missile defenses. Whatever this country does, when it starts to do it, whatever the first step is, will be relatively small to what might later evolve. It does have to stand the test of stability and supporting our national defense posture from inception through the full deployment.

The third area that we work very hard on is in the area of conventional armaments development. We do that with direct support from the Department of Defense. But the reason for raising it here is the technology base that it rests on is that set of investments

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that you have made over the years in our overall scientific and engineering capability. That is what has allowed us to work on armor penetrators, advanced armors, and new conventional torpedo warheads that we are working on at this point in time, and some of the techniques that we have developed to detect chemical and biological agents.

Lastly, I will finish up with an example drawn from the arms control and verification technology area which, as General Hoover mentioned, is also one of his responsibilities.

In order to talk about a couple of these points a little more substantially and because the issue of funds has arisen, I thought I would show you the way it looks for the 1980's at Los Alamos in terms of constant fiscal 1986 dollars.

LOS ALAMOS WEAPONS PROGRAM FUNDING

[Chart deleted.]

Dr. KERR. What you see is the technology base, below the yellow, which has grown somewhat in the first 5 years, but it has been relatively level. The development, engineering, and certification, the green, is the work we do to convert designs, passing through engineering development into things that the plants can manufacture. As you see, that has grown some in the last few years as well.

The blue, special projects, takes into account special analyses and other things we do for the Department of Energy. The red, testing, is tied very closely to that development, engineering, and certification in that many of our test requirements arise from those programs.

One thing I want to point out is this patched area, right here [indicating], in this technology base. That, in fact, is the best reconstruction we can do for you of the part of our technical base that has been for strategic defensive ideas. You will notice that it did not begin in 1983. It was going in 1980. In fact, it has been an activity of our laboratory for some 25 years at this point.

The technologies have changed. The kinds of military problems one might try to address with some technologies have changed. But there has been a steady and, we hope, fruitful exploration of these technologies so that the Congress and successive administrations can make some choices about them.

Senator HART. Are there any estimates as to the total amount of dollars spent over that period of time?

Dr. KERR. Over all time, Senator Hart?

No, sir. We could reconstruct it for our lab, but it would probably be even more difficult for DOE as a whole. By the time you combined it with DOD, it probably would be a confused number.

The reason is there are materials developments, accelerator developments, and laser developments that are generic technology. Retrospectively you could assign them, but you might put them somewhere else.

Senator HART. I understand. Thank you.

But it is a lot of money.

Dr. KERR. Yes, sir.

To give you an example, in 1972, the year the ABM Treaty was signed, the Department of Defense made a commitment to a pro-

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gram of research on the order of $500 million a year for research, so there was a substantial amount of money spent in just that 12 years, since 1972.

Dr. Wagner mentioned his concerns that SDI and some of these other activities—for example, a need to move funds from the weapons technology base and support work which had formerly been with the ICF—that would come as the strategic defense part did, here (indicating) within this region of technology base.

So, when you really get back to the fundamental asset, which is trained scientists and engineers, you are really talking about an allocation process of those people as well as the allocation of this country's financial resources.

So, the kinds of concerns that I can lay before you are those with the highest priority, the strategic force modernization, the SDI, ICF experimentation, or certain other areas. Our choice at Los Alamos has been to support the theater and strategic force modernization as our top priority, followed by the Strategic Defense Initiative as the new and growing activity with its great technological challenge but its much longer-term possibilities compared to the present needs for our military forces.

Senator BINGAMAN. I have a question.

The way the chart reads, there is a decrease in the resources going to the technology base, absent the work in SDI, is that right?

Dr. KERR. Well, you can say these things always in two different manners, Senator Bingaman. I would say a better way is because of the challenge of exploring some of these SDI technologies, in effect we have caused that to happen. It isn't that fewer resources are available. We think it is important to apply them in that area, and it may mean as a consequence that we are spending less on some engineering or physics study that relates to some other part of the program. But it is not imposed on us by the headquarters staff. That was a choice we made. So we have to defend it and live with it.

The other important point is that while the ICF or former ICF funds may be additive, they will be added at a level that is below the prior year funding, and so the other choice we will be having to make is whether to apply any of that technology base to those activities that might formerly have been supported by ICF, or whether it is sufficiently low in priority that we should not do that. That represents a set of technical choices.

BACTERIAL AND VIRAL IDENTIFICATION

Bacteria: Anthrax; Plague; Legionella.
Viruses: Influenza; Encephalitis; Herpes.

ARMS CONTROL AND VERIFICATION TECHNOLOGY

I wanted to mention the area of verification, and I have picked an example that is not a DOE program, but I picked it in a semiparochial way [deleted].

What we have done is developed a technique that uses a laser scattering from a liquid solution where the agent is contained. The scattered light is varied in frequency, that is, in color and polarization, and by looking over a large wavelength and through a whole

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set of polarization possibilities, we can see signatures of things like flu, the various different forms. We can separate A Victoria from Hong Kong. We have been able to identify anthrax and legionnaire's disease. And so we have been able to work broadly across some of the most infectious diseases, but also those that might be employed in chemical or biological warfare.

It was a program that started from techniques developed in our laser programs for DOD. It was supported in part by the National Institutes of Health and the United States Army and, in fact, today it is the basis for a new small business venture in New Mexico by a company that is attempting to commercialize this patented technology. where the license ultimately went to the inventor, to try to bring a product to the medical instrumentation marketplace.

[Deleted.]

Senator WARNER. [Deleted.]

Dr. KERR. [Deleted.]

There are other areas of verification where we have been working very hard as well. With our colleagues in Sandia, we continue to take responsibilities for the detectors that go into orbit to monitor the limited test ban treaty, and all three laboratories have been involved in one way or the other in the threshold treaty verification issue.

[Deleted.]

Mr. Chairman, that completes the remarks I wanted to make.

Senator WARNER. I thank you very much.

We will now hear from Dr. Dacey.

Senator GLENN. Mr. Chairman, may I ask a question before Dr. Dacey begins?

Senator WARNER. I thought we would open up the question once all three were finished, but you can go ahead if you want.

We will have an extensive question period when the three witnesses are finished, but if the Senator has a time constraint, please go ahead.

Senator GLENN. That's all right. I will wait.

Senator WARNER. We note, Doctor, that you may be making your last appearance.

Senator GLENN. I hope you mean just before this committee, Mr. Chairman.

[General laughter.]

Senator WARNER. I thank the Senator for that clarification.

STATEMENT OF DR. GEORGE C. DACEY, PRESIDENT, SANDIA NATIONAL LABORATORIES

Dr. DACEY. Mr. Hoover said that this was his first appearance in his present role. This is going to be my last appearance in my present role, though I hope not my last appearance.

The role, as you know, is President of Sandia National Laboratories. I have spent most of my career at Bell Laboratories because, as you all know, or perhaps you do not, that Sandia Laboratories is operated by AT&T under a no-profit, no-fee contract. That has an important bearing on what I want to say.

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THE STATE OF THE NUCLEAR WEAPON LABS

What I want to talk about today is the fact that the United States of America has in its three nuclear weapon laboratories a unique resource which I think is in danger. The fact that these laboratories are operated by technical people of long experience is unique in national and Federal laboratories. Most of our Federal systems operate in a totally different way, and, as a result, I think you get totally different results.

I think that that system, which is different from other places, is under attack in a sense. Let me tell you what I am talking about. There are several things that are happening. One is the initiative by Senators Nunn and Warner, that was mentioned today, and the Blue Ribbon Task Force that resulted from it. A question was asked earlier as to whether the DOE laboratories should report to the DOD, and I am going to address that in some detail.

We have had an Inspector General who has come out and questioned whether or not we are doing our building programs correctly, or whether there is adequate micromanagement from Washington. There are suggestions of putting the DOE into some other Government organization; the Interior Department, or somewhere else. There have been at least a half dozen studies as to whether we are doing a good job and whether we should be managed in some different way.

By the way, when we are talking about buildings, one of the things I think these laboratories do differently than other kinds of laboratories is the way we treat facilities. Private industry has what they call depreciation. They understand that buildings don't last forever and that you have to rebuild them, and so they take advance notice of that. We have to go through excruciating procedures in order to build the facilities that are required by the programs that have been authorized as programs, but not including the facilities.

All of these investigations and concerns and proposals and amendments—are they set up because the results are actually bad, or is it because the people don't like the process by which they are being done? I would like to say that I think the results are very good. They are unique. We often talk about the problems we have, and one of the reasons we are so good is because we look at what is wrong with us and we expose those errors and then correct them. Other people tend to talk only about the errors.

NUCLEAR WEAPON RELIABILITY

I would like to talk about performance. People have concerns about nuclear weapon reliability.

[Chart deleted.]

Here are the facts about the reliability of our stockpile. The composite reliability is [deleted] percent. That means that [deleted] the weapons would work if and when they were called upon to work. I don't think you will find any other device anywhere in our society, anywhere in the world, perhaps, except maybe the Russians' nuclear weapons, which will have that kind of reliability. We know our weapons have that kind of reliability because we [deleted]. So are we doing a good job in reliability? My answer is we are.

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NUCLEAR WEAPON DEVELOPMENT SCHEDULES

IOC SLIPS

	Technical Problems		Funding Problems		Other Causes	
	DOD	DOE	DOD	DOE	DOD	DOE
1960 thru 1969	8 Systems 74 Months	1 System 11 Months	None	None	5 Systems 89 Months	2 Systems 5 Months
1970 thru 1979	4 Systems 64 Months	None	2 Systems 34 Months	6 Systems 116 Months	7 Systems 77 Months	3 Systems 21 Months
1980 thru 1984	None	None	1 System 12 Months	3 Systems 81 Months	1 System 18 Months	None
Totals	12 Systems 138 Months	1 System 11 Months	3 Systems 46 Months	9 Systems 197 Months	13 Systems 184 Months	5 Systems 26 Months

There is a question of technical problems. One of the things I am very proud of in Sandia—and I am sure my colleagues in the other laboratories are equally proud—is that we tend to meet our dates on the date they are asked for and under the budget that we had available to do it. We have come in on price, we have come in on budget.

Here is a study from 1960 through the present of all of the schedule slips that occurred in our weapon programs as a result of different reasons: technical problems, funding problems, and other causes. That latter may be a euphemism for Congress, because at least some of our programs slip because the Congress decides we don't want to go that way. I think the [deleted] are a good case in point. I would like to call your attention to the fact that there is precisely one system that ever had a slip because of technical problems at a DOE laboratory. Contrast that with 12 that had slips because of problems in DOD areas. You can see the numbers there for yourselves. The point I am trying to make is if you make a comparison between the DOD system and the DOE system, the DOE system seems to be working pretty well.

NUCLEAR WEAPON COSTS

The question is raised, don't these things cost too much? In fact, in these very hearings last year there was a concern with the cost of one of the weapons. This concern was what at least in part, launched the task force. Well, when you ask if something costs too much, I think you should also ask the question "Compared to what?" and there aren't very many things in private industry to compare it with. But I searched around and I think I found one, and here it is.

REPEATER

This is an undersea submarine repeater. [Chart deleted.] It is the one that AT&T is about to put under the ocean. It is part of a submarine cable system which includes lasers and fiber optics, and

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which can carry many thousands of telephone conversations. It is a little bit comparable to a nuclear weapon. It is about the same size, about the same electrical complexity, but importantly, it also has to have very high reliability because it costs several million dollars to pull up the repeater from the bottom of the ocean and repair it. So it should stay there and never be touched for many years, similar to a weapon.

Furthermore, again, similar to a weapon, you don't make an awful lot of them, just a few hundred, that is just the number needed to go across the ocean in any particular route. Also like nuclear weapons, there has been a progression of these repeaters over the years. Each one has gotten better as they modified earlier ones. [Deleted.]

QUALITY OF THE NUCLEAR WEAPON LABORATORIES

Finally, the question is how about the quality of these laboratories? Are they really any good after all?

[Chart deleted.]

Well, here are some numbers about that. Recently Science Digest made a survey with a panel voting on the hundred best young scientists in America. Under 40 years old—that is how they defined young. Let's look at where they are.

The 100 brightest scientists in America under 40

Weapon design laboratories:	
Lawrence Livermore	5
Los Alamos	4
Sandia	3
Other DOE national laboratories:	
Argonne	5
Lawrence Berkeley	5
U.S. Government labs	2
Other leading institutions:	
Stanford	8
MIT	6
AT&T Bell Labs	5
Princeton	4
Chicago	3
Harvard	3

Source: Compiled from Science Digest, December 1984.

There are five in Lawrence Laboratories. There are four at Los Alamos, three in Sandia, five at Argonne, and five at Lawrence Berkeley. These are the DOE laboratories. In the totality of all of the Government laboratories, of which there are some 700, there are two more. Lest you think those are DOD laboratories, let me tell you they are not. One is a NOAA laboratory, and one is in the National Institutes of Health.

So our good scientists are in the DOE labs. All of the rest of them are either in industry, or at Stanford, or at MIT, in the universities.

So a precious resource, our brightest young people, are in these laboratories.

Senator WARNER. Now, can we take that and extrapolate it to the lesser luminaries?

[General laughter.]

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Dr. DACEY. I would not want to answer that in the case of my colleagues, but some of the older guys aren't that bad either.

[General laughter.]

The message I am trying to give you is that we have here a precious resource. It got that way in spite of Government procedures. It got that way as a result of the history coming down from the Manhattan Project when the scientists were turned loose by the Army, who said: "Do us something good." Many in the scientific community today, outside these laboratories, I am sorry to say, are not always in consonance with our national objectives, especially our defense objectives.

So my message is that we have a good system. It is not the usual Government system. It is unique, and it is very good. Let's protect it, and when you have a system that is working, if it isn't broken, let's not try to fix it.

Senator WARNER. I suggest that we have it because there are persons like yourself who are willing to make a good deal of sacrifices with your family and otherwise to take on a leadership role, too.

Going back, Mr. Nunn and I asked for the blue ribbon panel as a means to try to get some accountability of the dollars going into the various weapons programs in the totality of our defense program.

Now, gentlemen, I have a few questions.

We had some testimony this morning that was fairly jolting, in a way, from one of the Assistant Secretaries of Defense. I am going to try to put together his statement which was to the effect that he was specifically addressing [deleted].

[Deleted.]

So my question would be, in your specific areas of responsibility, how do you feel today about a disparity, if it exists, in favor of the United States, between our capabilities and that of the Soviets?

Each of you, I would hope, would put something in the record on that.

Dr. BATZEL. Well, I spoke to the issue of the X-ray laser as it related to SDI. [Deleted.]

Senator WARNER. Dr. Kerr.

Dr. KERR. There are really two questions that you have asked. One has to do with nuclear weapons technology.

Senator WARNER. I use that as a specific, assuming that you might wish to restrict your response to your own specialties.

Dr. KERR. [Deleted.]

[Deleted.]

Senator WARNER. Thank you.

Dr. Dacey.

Dr. DACEY. Well, in my area it is quite different, as you know, in that we don't work on the nuclear parts of the weapons, per se, but on the other parts that provide command and control, reliability, safety, verifiability, and so forth, of the weapon itself, and on the response of our weapons to Russian countermeasures and so on—more the engineering rather than the nuclear physics.

[Deleted.]

Senator WARNER. When we deal with the public, there is the perception that the United States can do everything bigger, better,

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and faster than the Russians when we decide to do it, but I think maybe I have to reexamine that question. I think there may be a gap.

Dr. DACEY. I think there are areas where we may be ahead. In microelectronics and computers we may be ahead, but there are other areas—especially, for example, in exploring way out theoretical concepts—where they may be ahead of us.

I think the bottom line is that we cannot afford to be complacent about any area.

Senator WARNER. When I was at the Pentagon, we used to say we had [deleted].

Dr. WAGNER. The Defense Science Board two summers ago did a broad survey of just that question in a lot of different areas. [Deleted.]

Senator WARNER. So you really have to break that out into specifics, and it is hard to make a general comparison.

I have one more question, and then I will yield to my colleagues.

We shall be addressing shortly the issue of the MX system in the context of the 1985 program as well as the 1986. I wonder if in your work—and I will ask this question of each of the lab directors, if you have worked on the question of survivability. Have there been any new thoughts in that area about the system as presently envisioned that have come to light in the various laboratories in the past 12 months?

For instance, has anyone done some work in fratricide?

We are now hearing from the Department of Defense under the various scenarios of attack, depending on the amount of warning time they get, depending on the time the first detonation takes place in the proximity of one of our MX fields. There is thought that a good deal of the system could survive and be launched before the attacking warheads "walk down" the remainder of the MX field.

Have you done any work in that area?

Dr. BATZEL. We have been involved in a supporting role in conjunction with efforts to further harden underground silos.

Senator WARNER. I would judge that there really is no response from any of the three of you on that subject.

Dr. DACEY. Well, I would like to make one point.

Our work on hardened microelectronics is clearly the key to survivability of our warheads; their ability to do the sophisticated things they have to do, after going through a hostile environment, including a fratricide environment. So, further progress in hardened electronics that we put into our own warheads, I think is important to this.

I think we are continuing to make progress.

We are intending to build a new laboratory, to go to the next generation of superhard microelectronics at the next level of integration. This is the Radiation Hardened Integrated Circuit Laboratory. I think that laboratory will be important in this whole issue of countermeasures and fratricide.

[Deleted.]

Senator WARNER. All right. Thank you.

I will yield for the moment.

Dr. Wagner, did you want to answer my last question before I go to my colleagues? Did you want to contribute to that point?

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Dr. WAGNER. Yes, if I may.

Twelve years or so ago, each of the three laboratories had a large weapons effects program that worked on survivability, among other things. Those programs are much, much smaller today.

Most of the work that was done in establishing the data base for survivability was really done originally by the DOE weapons laboratories.

Senator WARNER. Yes, that was my recollection.

Dr. WAGNER. That was just one example of the funding crunch and what the result has been.

I would dearly love to see those laboratories able to spend more work not just on weapons designs, but on the effects they produce.

Senator WARNER. I share that view.

It is a matter of great interest to me here in the Senate, the survivability issue, as it relates to MX, and a second opinion would be helpful.

Senator Bingaman?

Senator BINGAMAN. Thank you, Mr. Chairman.

Let me ask about the issue of verification.

We have the arms talks starting up in Geneva, and our chairman is going to be representing the Senate at those talks. I am concerned that in trying to get any kind of arms control agreement, we really are woefully remiss in not pursuing the necessary research for this verification technology.

I would be interested in each of your comments about whether you believe you are doing what should be done to support our arms control efforts and developing this technology for verification, and whether we in the Congress are doing what we should be doing in funding this.

Please answer in whatever order you wish.

Dr. KERR. All three laboratories, of course, have been active in this, but at a very low level. If you look at General Hoover's overall program and budget, the arms control and verification technology I think is well under 1 percent of his set of responsibilities.

If you ask are we doing all of the things that have promised to be helpful in that area, I would have to honestly say no, we have not been able to explore all of those things.

I think the laboratories have the capability to do rather more than they have in the past, but to some great degree that area of technology investigation has not gained much attention from either the executive or legislative sides of government. [Deleted.]

Dr. BATZEL. The way the efforts are distributed today, at least among these three laboratories, has been sorted out so that we work in complementary areas.

Our effort centers around seismic related means for verification of nuclear tests, for example.

My view is that in that area we are doing a reasonable job.

We have not been in a position to expand those efforts into other areas. [Deleted.] But just what that ought to be or could be I am not prepared to say right now.

Dr. DACEY. Well, we are doing quite a bit of work, as you know, in satellite verification of various kinds. [Deleted.]

If you folks are interested, we would rather give you a separate briefing on that at some time.

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But if you ask, are we doing as much as we should, I think I would have to ask the question in reverse: How much should we do?

I would agree completely with my colleagues and say that it would seem to me, just as a fundamental principle of negotiating from strength, that it makes more sense to negotiate treaties that you can verify instead of trying, after the fact, to verify treaties that you have already negotiated.

In that connection, I think there is a disconnect between the scientific capabilities for verification, which the scientists know about, or can at least give some opinions about, and the negotiating process. [Deleted.]

Senator BINGAMAN. Let me ask about the same issue that I asked General Hoover about, the inertial confinement fusion.

I am concerned, as I stated before, that perhaps the proposal to dramatically cut the funding in this area is premature and comes before we have the recommendations of this technical review group.

I would be interested in knowing from each of you whether you believe that is the case, whether you believe that your facilities can obtain the necessary research data at the level that is proposed, or where we, the Congress, should go in this area of funding for inertial confinement fusion.

Dr. KERR. I think we, like you, are, of course, very interested in what this scientific review panel will come forth with in terms of opinions and recommendations. Rather than prejudge that, I would like to make another point about these facilities, which is simply this.

While they have been authorized and built within the ICF program framework, they, in fact, are exceedingly valuable facilities for everything from weapons effects and survivability studies to the exploration of basic weapons physics. They have become a very intimate and almost inseparable part of the conduct of the nuclear weapons program, as well as the work that is done with them addressed to specific ICF aims.

It is hard to make clear separations. In proposing that the ICF program be contained within weapons R&D, that relationship to the weapons program becomes even more clear. In fact, flexibility to use those resources for weapons physics, survivability, and lethality studies exists.

The real question is whether the total resources available for weapons research, development, and testing are commensurate with what obligations we have in the nuclear weapons development program, the SDI area, the basic weapons technology area that this ICF capability helps support, and the ICF objectives themselves, which would now be incorporated within it.

Senator WARNER. Excuse me. I have to depart.

Senator Bingaman and Senator Glenn, I wonder if you two gentlemen might conclude the hearing for me? Just go right ahead with questions, as you desire.

I thank all the witnesses for their participation today and I leave with a note of encouragement.

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We will give you adequate opportunity to come and address the Congress, particularly the Senate on this issue, before any decision is made.

Dr. KERR. Thank you, Mr. Chairman.

To just conclude the last point, the real point is to see if the total resources available are commensurate with the set of tasks that we are expected to carry out. That, then, really is a matter of program priorities, and then, within those programs, what specific technical activities are most important to conduct.

Senator BINGAMAN [presiding]. Do either of you other gentlemen have points to make on that?

Dr. BATZEL. Yes.

As I pointed out, we have just completed a new facility. It is an investment of a couple of hundred million dollars. It has produced a facility called Nova which I think is going to be extremely useful to the nuclear weapons program in its own right.

The level of support available within the framework of what is now allocated to ICF will not support operation of that facility.

At least at this stage of the game, it appears to me that I would have to supplement--and I think that is the way the priorities could come out—those available dollars with dollars out of weapons research and development funds in order to operate that facility.

I think from the overall weapons point of view that is going to be a reasonable balance.

That will not be an optimum program for utilization of that facility, but it will allow us some operation.

I certainly would not want to see transfer of dollars from weapons research and development tests over to ICF. It does not solve any problem at all. It is a zero-sum game. That does not help.

So, from my point of view, the resources are not adequate. But I will balance as best I can, with the resources that I have.

Dr. DACEY. Well, I guess the position at Sandia is very similar.

As you may know, within the last month or so, we had a startlingly good new result in PBFA-I. We have managed to focus the beams to a very high density, about 1.5 terawatts per square centimeter, which looks like, when we extrapolate these focusing techniques to PBFA-II, we should have power densities sufficient for ignition.

PBFA-II is under construction, is funded, and is going very, very rapidly indeed. I would invite you, particularly, Senator Bingaman, when you are in New Mexico to come and look at it because it is a very impressive new building. That building will be finished very shortly. But 1986 funds are not adequate to operate this new facility, even in spite of these promising new results.

What does that mean? It means exactly the same thing to us as we have just heard from my colleagues, that we will have to keep from shutting the facility down, because that would not be in the national interest. It, too, is particularly useful for weapon effects and other kinds of weapon programs as well as just ICF. But we will have to restructure the RD&T program to use those facilities as best we can within the budget that we have. It will mean that we will not be able to reach the ICF objectives as early as we otherwise could. We might be doing more weapon effects and less ICF.

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which means that the ICF demonstration, instead of happening, perhaps, in 1987 or 1988, would be off into the 1990s.

Senator BINGAMAN. Let me just conclude. I have a few other things here.

Let me say that I would like after the hearing, sometime in the next week or so, to try to get any information that you would have on items that would improve our capability in verification technology from your point of view that might be added to the 1986 budget, if this committee were in a position to do that.

Senator BINGAMAN. Senator Glenn?

Senator GLENN. Thank you.

I would like to follow up on that just a little bit. I get the impression that all of you feel there are more things that could be done in looking into various means of verification.

Is that correct?

Dr. DACEY. Yes.

Dr. BATZEL. Yes.

Dr. KERR. [Nods affirmatively.]

Senator GLENN. I think it would be tragic if we do not provide that kind of backup for you.

Dr. Kerr [deleted].

I talked to you once before about a different idea here, perhaps. I feel it is going to be extremely difficult to do something like that, and I cannot pass up this opportunity, with three experts like yourselves here, to take a little different line of questioning now.

If we cannot measure every one of 10,000 warheads out there with any reasonable assurance, then what I have thought about for some time is are there any chokepoints of other material, as you come back from those weapons, where we could measure something that gives us an overall measure of the Soviet bang capability, gross though it might be, and they could make the same kind of measurements on us?

In other words, it could be a new basis for arms control verification.

Now tritium has a half-life of 12 years, I believe, isn't that correct?

Dr. BATZEL. Yes.

Dr. KERR. Yes, about 12 years. That has to be replaced.

Senator GLENN. Yes, that has to be replaced. We have to take them off the stack, take them in, do things with them, replace them and put them back out again.

I presume the Soviets would have to do the same thing.

Is a measure of tritium production, then, a chokepoint where you can measure it to get an idea of what the overall bang capability the Soviets have is? Can they do the same thing with us?

[Deleted.]

What I am trying to get at is are there any items like that where we could make some sort of measure of their capability and they could do the same of ours which could be a new basis for verification in arms control?

[Deleted.]

I am just searching for anything, and I would welcome any advice at all, even if you think I am barking up the wrong tree.

Let me ask one other thing.

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There is a study out of Princeton, from a seminar they had, where they feel they can, within 10 percent, verify a cutoff in production of plutonium and highly enriched uranium for nuclear weapons.

I would like to try to get copies of this and send it to each of you [indicating]. It is only 30 pages and I would welcome each one of you looking at it and telling me whether it is worth pursuing or whether they are way off base.

I would like for you to provide that for us if I can get copies of this for you, which I will do.

Maybe it is a laughable proposal and maybe it is a great proposal. I have no way of knowing.

But if there are any of these choke points that you can think of which will give us a new handle on this problem, now is the time to do it, while people are just starting the negotiations.

Dr. KERR. Senator Glenn, it is interesting to contrast that 10 percent number [deleted].

The Soviet offer to open their civil nuclear facilities at least in part to IAEA inspection would tend to remove them as a potential source of clandestine production, if that were really to come about. So that would be a step in the direction that you are talking about.

Access to the military facilities would also be required if it were to be a verification technique.

Senator GLENN. How many facilities would you figure they would have to have for tritium? Would it be 1,000, or 10, or 5? What might it be?

Dr. BATZEL. [Deleted.]

Senator GLENN. [Deleted.]

Dr. BATZEL. [Deleted.]

Senator GLENN. [Deleted.]

Dr. DACEY. [Deleted.]

Senator GLENN. Maybe the first step is to get them to say OK, we will limit our production to *x* number of facilities and we will do the same thing in our country here.

I just know intuitively, from having been through it before, that unless we can monitor and verify whatever agreement is arrived at, it will be just so much paper that will not be approved. I will probably be out there in the lead fighting that blooming thing, to be honest about it, as I was on SALT II, because at that time we were buying a pig in a poke, or so I felt. There may be disagreement in the room here on that point.

But I just do not want to be placed in that position again. I don't want my Nation to be placed in that position again, where we get a ballyhooed agreement with the Soviets and everybody comes home triumphant, there are big meetings with all sorts of flag-waving, and then we find out that we cannot verify the agreement, so we have to go out and be very unpopular and fight against ratification because we cannot trust the Soviets to always operate in our best interests.

Dr. Wagner, did you want to say something?

Dr. WAGNER. I just wanted to add what is now a small point in that context, which is that it is possible to make nuclear weapons functions without tritium. But we don't do it very much. But it is possible to do that.

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Senator GLENN. I just used that as an example. I did not think there was any magic in that area. I was just trying to come up with something, short of counting 10,000 or 12,000 warheads, wherever they may be, underground or wherever they are, to come back to some sort of choke point, such as in the production line, where something would give us an indication of the overall bang capability that they have out there. It might be a little inaccurate, but at least it would be better than what I think we are going to have right now. But we don't have much of an idea right now.

I would appreciate any thoughts you might have in this area, or any thoughts you might have on experimenting or research moneys that we would need to look into some of this.

Dr. BATZEL. I think you may well have a much better chance of counting missiles than warheads.

Senator GLENN. Well, then, OK. A missile count obviously has some difficulty. You can say that they are ahead of us in missiles [deleted].

Dr. BATZEL. Well, I know.

But from the point of view of counting things, if you can get into their production facilities on missiles, I think it would be a bigger item.

Senator GLENN. Then you are back to the number of warheads on each missile and how do you verify that, as less testing is done. And as they encrypt, we cannot measure those numbers again, and so we are back again to SALT II, basically.

Dr. DACEY. One of the things, it seems to me, that is excruciatingly easy to verify, assuming that you can really do it, is verifying what you have destroyed. If you destroy something in somebody's plain sight, then you count one. That one is gone. You don't know how many are left. You don't know how many they started with. You don't know how many they are making surreptitiously, but at least there is one less than they otherwise would have had, if you destroy them at each other's site.

So it seems to me a reduction kind of verification is much easier than trying to find out what is there in the first place.

Senator GLENN. Gentlemen, I would appreciate your either providing any information that you may think of to the committee or to me personally and I will bring it to the committee's attention, because this is something that I have thought about a lot, and we have talked about it a little bit in the past.

I will get copies of the report from Princeton sent to you, and as I have said, I would appreciate your comments on it. It is only 30 pages long. You can look through it pretty fast.

Does anybody else, any of the crowd of assembled experts in the room have any thoughts along this line?

Dr. WAGNER. I would say only that there is not a comprehensive, dedicated block of funding to do this kind of work.

ACDA does some. But I think it is just a trivial amount compared to what probably could be done. It is the kind of thing that I think you ought not look at for results in 5 or 8 years. You have to begin, to build a base, and a lot of effort will be wasted, but eventually perhaps something will turn up.

Dr. DACEY. There is one other thought that I would strongly urge upon you, and that is that there seems to be something backward

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in our logic, in that we focus our attention on verifying things which ultimately have to do with research and development, which are at the beginning of the cycle. It kills nobody and it is dangerous if you do not have information. But at the other end of the cycle are real weapons that have been manufactured. There they are, ready to be shot. We ought to be working on the weapons and not on testing, because it seems to me that one thing we will never succeed in verifying is what is going on inside the scientist's head. He is going to be thinking and inventing, surreptitiously or out in the open, and we will never know what he is thinking about unless we have people thinking, too, and testing is part of thinking.

So, to my mind, trying to negotiate arms control agreements on R&D is going at the wrong end of the stick.

Senator GLENN. Let me take a slightly different approach. I know that it is getting late and I apologize to you, Mr. Chairman.

Senator BINGAMAN. That's all right. Go ahead.

Senator GLENN. Let me take a different tack.

Is there any way that we could put in an identifier with their nuclear weapons so that there is a way to monitor that remotely, wherever it goes? I don't mean just a radio signal, but is there some sort of emission or radiation that could be included? In that way, if you ever see one that does not have a device, you can measure it. You can spot the numbers. If you ever find one that is not emitting, it is a clandestine one that was manufactured and that should not be.

Is that a possibility?

Dr. KERR. In principle, yes.

Senator GLENN. Are there materials that we could put in, short of a radio beacon, on every one or something like that? I mean materials that radiate which we can pick up from space or with remote monitoring.

Dr. KERR. There are a variety of techniques that could be used, yes.

Senator GLENN. Is that a requirement that we should be talking about to the arms control people?

Dr. BATZEL. One has to talk about access, again.

Dr. KERR. Unless there is someone or something you can interrogate.

Senator GLENN. I was talking about something that you can remotely monitor. Is that not possible?

Dr. DACEY. It is a question of how remote.

If you are close enough to pick up the actual radiation from the nuclear materials——

Senator GLENN. That would be right on top of it.

Dr. DACEY. Not necessarily on top—close, but not right on top. It could be behind a barrier or something of the sort.

You are beginning to get into situations, I think, in which the surrounding kinds of safeguards would be more complex than the actual measurement itself. We have all seen a magician who makes an elephant disappear behind a curtain, and so on. If you see something and are allowed to go up near it and put a measuring device against it, you can probably say with very high reliability that there is uranium or plutonium inside that thing. If you are very great distances away, the chances are that you cannot.

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Senator GLENN. But is there something we could lace that with that would let you measure farther away?

[Deleted.]

Senator GLENN. Is there anything that we could lace fissile material with, whether it be plutonium or HEU, that would be measurable at any distance so that that would be just part of the batch that they were manufacturing, wherever they did it?

Dr. BATZEL. I think if you look at the levels of radiation that you are going to have to put in there, and you are talking about gamma radiation, for example, or neutrons, the levels of exposure for people standing nearby would have to be so high as to make that impractical.

Senator GLENN. Well, that is the line that I am thinking along. I would appreciate your help. I don't have the answers, obviously. But I am trying, I would say nearly desperately, to find something. I don't know of any three people who I could talk to who would be better in line to give us some ideas on this. If you could think of anything, I would sure be willing to carry forward on whatever funding you need or whatever efforts would be necessary to get some more information, so that we could take it over there before we go so far down the track on arms control talking a year or so from now that we would be beyond considering anything like this. Something like this would have to come in fairly early in the talks if it is to mean anything.

I just do not want to see us go down the same old track again. It will be useless. We will build people's hopes up and then just dash them once again. I don't want to see that happen.

Thank you, Mr. Chairman.

Senator BINGAMAN. You're welcome.

We have testimony from Admiral McKee, Robert McCrory from the University of Rochester, and Alexander J. Glass, KMS Fusion, Inc., and their prepared statements will be included in the record.

[The prepared statements of Admiral McKee, Robert McCrory, and Alexander Glass follow:]

PREPARED STATEMENT OF ADM. KINNAIRD R. MCKEE, U.S. NAVY, DIRECTOR, NAVAL NUCLEAR PROPULSION PROGRAM

INTRODUCTION

This month marks my third year as Director of the Naval Nuclear Propulsion Program. The time has gone fast—we have been busy. I would like to bring you up to date on how we are doing and where we are going.

Today, my organization continues to exercise a singular responsibility, and remains accountable, for the safe and effective operation of 172 reactors—ashore and afloat. It is the largest reactor program in the free world, with a cradle-to-grave responsibility for all aspects of naval nuclear propulsion. There are many subdivisions of that responsibility, but it all boils down to a fundamental requirement to establish and maintain two essential characteristics—combat effectiveness and reactor safety.

From the beginning, Congress recognized the importance of central direction in this program. President Reagan's Executive Order of February 1982 articulated specific elements of the charter, and last year the Congress codified his directive in PL 98-525.

Our program continues to expand as increasing numbers of nuclear powered ships join the fleet. The scope and difficulty of our work has also been affected by the increasing age of earlier ships and by the need to deal with an increasing number of decommissioned reactor plants. In spite of this, the size of my headquarters organization remains austere.

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SUBMARINE PROGRAMS

We now have 94 attack submarines and 36 ballistic missile submarines, including five Tridents. Eighteen more SSNs and seven more Tridents are authorized. Five *Los Angeles* Class and one Trident submarine were added to the fleet last year. The Navy's FY 1986 budget request includes one more Trident and four additional *Los Angeles* Class submarines. The Department of Energy must continue to oversee the construction and testing of propulsion plants for these ships. The Navy budget also provides for continued work on the new design attack submarine (SSN-21). My DOE budget supports Advanced Fleet Reactor development for this ship.

Last month we completed initial sea trials of *Alabama*—our sixth Trident submarine. The shipbuilder and the Navy crew did a good job—the trials went well. Once again, I was impressed by what we were able to do with these ships, almost immediately, sometimes under adverse operating conditions that would tax even a seasoned crew. That was very clear during this trial because it was conducted under some of the worst storm conditions of the year. Fifty knot winds with twenty foot seas arrived in time for our initial dive, but the trial continued and the crew handled it well. A remarkable group—as are the people associated with design, construction, and operation of our nuclear propulsion plants. I'll say more about that later.

Last year we decommissioned four submarines, bringing the total to 10. *George Washington*, our first Polaris submarine, was one of these—retired without fanfare after silently and effectively performing her mission of deterrence for more than twenty years. She never fired an armed missile. In the business of deterrence, that is the absolute definition of success.

SURFACE WARSHIPS

Last November, the nuclear powered aircraft carrier *Theodore Roosevelt* was launched by Newport News. When commissioned in 1986, she will bring the Navy's CVN force to five. Construction of the two other authorized CVN's is ahead of schedule.

On the other hand, the Navy still has only nine nuclear-powered cruisers. No new ones have been authorized in over 10 years. That means only about one nuclear cruiser for each CVN when all seven become operational.

OPERATIONS

The performance of our nuclear powered ships continues to be remarkable. Their safety record has remained impeccable. They have now traveled over 60 million miles, from the North Pole, to the Indian Ocean, to Cape Horn, without a reactor accident or a release of radioactivity that has had a significant effect on the environment. Nuclear powered ships continue to work hard—in fact, harder than most. A recent letter from one of the nuclear powered cruiser skippers reflects what nuclear propulsion meant to his deployed tempo of operations:

COMSIXTHFLT significantly reduced Mediterranean operations because of potential over-expenditure of the FY 85 first quarter conventional fuel allocation. A majority of the battle group was in port by early or mid November and scheduled to stay in port through December for upkeep and maintenance. Many of the ships went cold iron to conserve additional fuel. The end result was the two nuclear powered ships deployed were underway 70% of last quarter while the conventional ships averaged about 30-40% of the deployment underway.

Another letter from a nuclear powered attack submarine Commanding Officer is also illustrative:

Dallas departed Groton for a seven month Indian Ocean deployment on 18 May. We are moored to USS *Proteus* (AS-19) undergoing a scheduled 30 day upkeep, the only upkeep time scheduled during that seven months. Since leaving Groton, *Dallas* has steamed 23,985 miles, operating 186 hours at full power.

By the time *Dallas* returned home she had steamed over 58,800 miles on this deployment.

All of these ships maintain a high tempo of operations, but more important than how hard they run is what they do. Last year, you heard a top secret briefing that described several years of highly classified operations by our attack submarines. I won't go into detail again this year, but recently completed polar operations by *Gurnard* and *Pintado* are an example of the past year's work. These ships operated under the polar ice cap for seven weeks, conducting one of the most sophisticated naval polar expeditions in history. Their job was to learn more about how to fight and survive in the most inhospitable environment in the world. They did well in challenging, round-the-clock schedules of tactical exercises, R&D testing and envi-

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ronmental data collection. Their operation culminated in surfacing together at the North Pole.

One of the strengths of our program has been our ability to integrate this sort of experience into our ship designs. Officers with this experience have played an important role in the development of our new ships and equipment and they continue to do so. That's important. They know what needs to be done because they have been there—and they have the technical competence to factor that experience into current and future designs. This is one of the reasons that the SSN 637 Class, a 30 year old design, and the SSN 688 Class, a 20 year old design, can still handle the current Soviet threat. Our concern is for the future, and that concern underscores the importance of SSN 21.

NEW DEVELOPMENT

SSN-21 work is moving along well. Preliminary design of this ship is nearly complete and contract design will start later this year. Meanwhile, our DOE work on the reactor plant continues on schedule. We are combining the results of ongoing DOE and Navy research and development with Trident equipment design and manufacturing experience to develop the most cost effective product.

Bettis Atomic Power Laboratory is the principal design agent for the reactor plant. Assisted by the Knolls Atomic Power Laboratory, and the Electric Boat and Newport News shipyards, they are working to produce the quietest, most powerful submarine propulsion plant yet fielded by this country. It will have to be, if we are to handle the 21st century threat against which the ship will ultimately be measured. SSN-21 must be fast, as well as heavily armed, and unlike earlier U.S. submarines (and even the most recent Soviet designs), it must be extraordinarily quiet across its entire speed range. Finally, we must develop a propulsion plant that will enable SSN-21 to achieve these goals without sacrificing the fundamental design principles that have served this program so well for so long.

BUSINESS STRUCTURE

The SSN-21 propulsion plant requires substantial improvements in four principal areas—quieting, power density, resilience, and producibility. Taken together, these represent a formidable technical challenge. To meet that challenge we must draw heavily on the best facilities and most experienced talent available in our laboratories, prime contractors and principal vendors. We are doing that within the same proven business structure that has served this program well for so many years.

Principal research and development is being performed at two Department of Energy owned, contractor-operated laboratories—the Bettis Atomic Power Laboratory and the Knolls Atomic Power Laboratory. Naval Reactors headquarters supervises all technical and financial aspects of this work.

As lead laboratory, Bettis is developing the core design. Knolls is concurrently and independently validating that design. Bettis is also designing the reactor plant systems and procuring core-related components.

Two engineering/procurement organizations dedicated solely to naval nuclear propulsion program work—Westinghouse's Plant Apparatus Division and General Electric's Machinery Apparatus Operation—are also heavily involved. Using system descriptions and requirements developed by the design laboratory, these two prime contractors are developing specifications to which equipment other than that provided by Bettis will be procured. All of these technical requirements, specifications, procurement plans, and order placement recommendations will be approved by Naval Reactors headquarters. The Government will also retain rights to all technical data to ensure a proper competitive environment as the program moves into series production.

The prime contractors are drawing on our established industrial base to carry out this program. Hundreds of firms are involved at various levels within the Naval Nuclear Propulsion Program. About 40 of these can be considered major equipment suppliers.

Over the years, Congress has recognized the importance of a strong industrial base for the Naval Nuclear Propulsion Program. The work is demanding, much of it involves precision machining, sophisticated welding, and extremely careful attention to quality. In fact, our stringent requirements for quality assurance make it necessary for many suppliers to perform this naval work separate from other commercial activities. For others, the Naval Nuclear Propulsion Program is virtually their only customer. In this environment, we have to strike a careful balance that sustains healthy competition without disrupting the industrial base. This is a difficult task, because manufacturing lead times are long—often four years or more—and quanti-

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ties are small. Where the Navy may buy several hundred aircraft engines per year, we buy four or five reactors—sometimes far less. Where aircraft engines are delivered in two years, nuclear components take four or more.

NAVAL PERSONNEL

Thus far, I have dealt with the technical, operational and business aspects of our program, but none of what has been accomplished would have been possible were it not for the relatively small numbers of people who bring the ships to life and others who drive them into harm's way. The men who operate these ships must be very good at what they do. Wherever they go, they must expect to be outnumbered. If they're not outnumbered, they're probably in the wrong place.

That means we must develop crews and ships that can operate alone and unsupported, in waters controlled by the enemy. They must be able to do grievous harm, and survive in the face of overwhelming odds. It takes a high performance ship to do all that, but more important, it takes a special breed of men. It doesn't take many. In the past 30 years the nuclear program has trained only about 10,000 officers and 50,000 enlisted men.

It is hard for most folks to comprehend, much less appreciate what we demand of these people; however, Joseph Conrad's description of "The Commanding Officer" is illustrative:

In each ship there is one man who, in the hour of emergency or peril at sea, can turn to no other man. There is one who alone is ultimately responsible for the safe navigation, engineering performance, accurate gunfiring and morale of his ship. He is the Commanding Officer. He is the ship.

This is the most difficult and demanding assignment in the Navy. There is not an instant during his tour of duty as Commanding Officer that he can escape the grasp of command responsibility. His privileges in view of his obligations are most ludicrously small; nevertheless command is the spur which has given the Navy its great leaders. . . .

"His privileges, in view of his obligations, are most ludicrously small. . . ." Those words really fit the whole crew, not just the CO.

Those of you who have gone to sea in a nuclear-powered ship know what I mean. You have met those guys in their own element, seen what kind of men they are, and understand what we ask of them and of their families.

NUCLEAR TRAINING

The nuclear-trained officers and men in those crews are held to particularly tough standards. They must maintain a completely professional attitude on watch—no small talk or non-work-related conversation—only constant attention to the operation of the reactor plant. There is never a minute without pressure, without thinking "What if" and "What will I do if. . . ."

They must understand and work with some of the most technologically advanced concepts and equipment in the world. All have passed a rigorous screening and selection process. Each has received six months of theoretical instruction by the Navy. The course is deliberately made tough to challenge and bring out the best in them. It is hard to qualify for entry, and hard to pass, but it is the only way to develop the fundamental understanding that is an essential prerequisite for safe operation of a nuclear propulsion plant.

But even that fundamental understanding is not enough. They must also become skilled operators, with an instinctive feel for the plant that can only be developed in an operating environment.

That process begins ashore, at prototype plants under the direction of the Department of Energy. This is where our reactor operators undergo basic training on a real reactor and where they first learn the real consequences of their actions.

The process continues at sea, with advanced training in operating ships where they learn to deal with the unexpected and, if necessary, to "play hurt." Eventually they must reach the point where they can react to a casualty in a matter of seconds, achieve a stable condition, then fix what broke and restore the plant. And they have to do it alone, because it's a long way to the hardware store, and they cannot expect help from itinerant technical representatives.

The standards are high because the consequences of a mistake are grave. Any relaxation would be foolish at best, and at worst, most perilous. That is why I tend to lose patience when some folks suggest that we train new reactor operators on simulators. "Why not?" they say. "Wouldn't it be just as good—and a lot cheaper?" The answer is no—it would not be as good, and certainly not cheaper. It would be an

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unequivocal reduction in our standards, and the cost of inadequate training in this business is incalculable.

Experience has proven that our people can only develop adequate skill and the proper instincts in an environment where there are real consequences for their actions. If a trainee makes a mistake he must know that he cannot recover by simply resetting a computer program. It is also important that the instructor have a real personal stake in his students' performance. Reactor operators must be trained under conditions which are identical to those they will encounter on board ship. At sea, a mistake may cost their lives, and those of their shipmates. In port, it could have broader, and perhaps even graver consequences.

COMMANDING OFFICERS

Commanding Officers deserve special mention. As junior officers, they have all been through all of the training I have described, and more. Each has served in many jobs on a number of ships. Each has qualified as an Engineer Officer. They must then survive a very competitive screening process, first for assignment as Executive Officer, then to command. The only exception to this sequence is for CVN Commanding Officers who undergo nuclear power training after having been selected for assignment as Executive Officer on an aircraft carrier. Each officer selected for command undergoes 3 months of concentrated study and examination in my office before he can assume command. When he gets to his ship, he will have to serve longer in the job than any other Commanding Officer in the Navy.

They are the best of their profession, and they carry immense personal responsibility for the safe operation of one or more nuclear reactors, in port as well as at sea. They must also be ready to do the unthinkable—to unleash their weapons if called upon by duly constituted authority. All the while, they understand better than most, the personal as well as national consequences of such an action.

You should ask yourselves what kind of men you want to carry such responsibility. Ask the question not just of the CO, but of his entire crew, then consider what should be done to ensure that we will have such men when we need them.

HEADQUARTERS PERSONNEL

Congress, recognizing that these men are a principal reason for our success, has supported a number of important initiatives to help retain these operators. But the operators must also have the tools to do the job, and that would not be possible without the support of a top flight technical organization. Admiral Rickover built it—and his legacy remains intact. Many of my most experienced and knowledgeable senior civilians have been in the business for more than 20 years. In that time, their responsibilities have grown immeasurably, while the size of the staff has remained austere. They stay in the Government because they are committed to excellence, can demand it of others, and because they believe in what they do. We can't afford to take them for granted. For dedicated senior people who have routinely worked long hours and 6-day weeks for decades—with no overtime and little recognition—the public concept of indolent, overpaid federal bureaucrats wears pretty thin.

Good people are the heart of this program. Without them, the most advanced technology we can muster is of little use. These people know their worth, but they are too few and too busy to sound the trumpet. They depend on you, and their success is your legacy. Without your continued support and understanding the Navy might find all of its nuclear-powered ships—over 40% of its combatant strength—at risk, without a shot having been fired by any potential enemy.

BUDGET

We must also give these people the tools to do the job. Our budget request is structured to do that. The total for Fiscal Year 1986 comes to $569 million. You will observe that represents an increase over last year, but please recall that there was no growth in my FY 1985 budget.

$489 million of the total is for operating expenses. Principal categories of that work include:

Research, development, and support work needed to keep the existing nuclear power plants running safely;

Operation, maintenance, and servicing of the prototype plants, which we use for research and development and for training; and

Continuation of our work on the Advanced Fleet Reactor for the new attack submarine.

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Also included in the request is 30 million dollars for capital equipment and 50 million dollars for construction project funding. The construction funds are to complete two projects and for one minor new project involving modifications to a test reactor facility.

I have attached an expanded explanation of my budget request and two reports describing the program's performance during the past year in controlling radioactive waste and occupational radiation exposure.

FISCAL YEAR 1986 DEPARTMENT OF ENERGY BUDGET REQUEST FOR THE NAVAL REACTORS DEVELOPMENT PROGRAM

The Naval Reactors Development program involves design, development, improvement, testing, and evaluation of nuclear propulsion plant components and reactor cores. The goals of this effort are: to enhance the performance and reliability of naval reactors while simplifying operating and maintenance requirements; and to design and develop advanced reactors for use in improving the capability of present and future nuclear powered naval warships. Throughout all design and development work, plant safety and reliability are of paramount concern.

Currently powering over 40% of the Navy's combatant vessels, nuclear propulsion plants enable these ships to operate alone and unsupported, limited only by their weapons load and crews' endurance. As potential adversaries continue to make strides in nuclear propulsion technology, continuing improvement of our naval nuclear propulsion plants is critical to maintaining our advantage in this vital National defense area.

Consequently, ongoing efforts aim at developing advanced reactors with improved performance. Specific performance objectives are: increasing maneuverability; improving quieting; reducing ship transit time to and from stations; increasing overall effectiveness in a combat situation; increasing ship operating availability; reducing the need for costly refueling and servicing operations; minimizing the production of nuclear waste; and reducing personnel radiation exposure.

Effort is being applied to the Advanced Fleet Reactor which will power the next generation of nuclear powered attack submarines. The Advanced Fleet Reactor will concentrate many of the current advances in reactor concepts, components and materials generated from ongoing development effort.

Other major or associated developmental work includes a Modified Fuel Process for producing improved fuel elements which will increase reactor life and power; a higher power, longer life core for shipboard application; a Submarine Test Core and Developmental Materials Core to test improved reactor fuels, materials, and configurations intended to provide improved plant performance; and development of advanced plant concepts which offer improved power characteristics and reduced detectability.

Development and analysis work continues beyond the point where a plant system or component is introduced into fleet use. The operating life of this equipment may exceed 30 years. During this time, work continues to assess and evaluate material performance, ensure safety, and understand long term phenomena. Work also goes on to develop, test, and apply improved cores, components, and systems to existing plants. Operating data obtained from equipment in the fleet provides a valuable source of information in the development of new plants, components, and systems.

The Program operates eight land based prototype nuclear propulsion plants which are integral to the development, testing, analysis and evaluation of new reactor cores, components, materials and concepts and to the training of Navy operators. Once a plant or component goes into operation in the fleet, the prototype plants provide empirical data on plant performance ahead of fleet experience. This allows assessment of long term performance, special testing, and determination and resolution of any problems before they are encountered in fleet units.

The Fiscal Year 1986 Naval Reactors Development budget request is $569 million, a $72.1 million increase over the Fiscal Year 1985 budget. The increase is due primarily to: escalation; increased prototype servicing effort as the overhaul and refueling activity enters its busiest phase; final funding for the Modifications and Additions to Prototype Facilities project; development and fabrication of Advanced Fleet Reactor prototype equipment; and modernization and upgrading of the Advanced Test Reactor.

The details of the request by major area are:

Budget Authority

	Millions
Reactor development:	
Operating expenses	$261.3

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Capital equipment	30.0
Construction	50.0
Subtotal	341.3
Plant development: Operating expenses	66.0
Reactor operation and evaluation: Operating expenses	150.0
Program direction: Operating expenses	11.7
Total, naval reactors development	569.0

The following discussion summarizes the work in these major areas:

REACTOR DEVELOPMENT

Reactor Development aims at improving the power, reliability, and endurance of naval reactors. Experience gained from operating reactors is applied to development of new reactor designs, concepts, and materials which can be incorporated into existing or new design reactors. Advanced concepts resulting from applied research and emergent technological advances are also used in improving naval reactor capabilities and ensuring the longevity of naval reactor plants. Analysis of each type of reactor continues as long as a unit continues in use to assure plant safety and assess operational criteria.

New and improved reactor fuels and materials are basic requirements for enhanced reactor power and endurance. Physics and fuel characteristic studies and tests determine optimum core arrangements and fuel attributes. Better fuel manufacturing processes and fabrication techniques allow use of more capable reactor fuels and more accurate prediction and determination of core operating characteristics, thus permitting better use of potential reactor power. Since even small amounts of material corrosion and distortion can significantly contribute to reduced core performance and lifetime, developing new materials, determining reactor material characteristics, and understanding phenomena such as embrittlement are instrumental in realizing the potential gain in performance from the new fuels.

Design and development of advanced reactor cores is an iterative process with multiple data sources. Analytic models aid in the design and development of advanced reactors and evaluating reactor performance. Data from these models and operating fleet plants, test results from the prototypes plants, and information obtained from examining spent reactor cores, are vital to maximizing the performance of new reactor plants.

The premier Naval Nuclear Propulsion Program development effort is the Advanced Fleet Reactor. The Advanced Fleet Reactor will feature a higher power reactor in addition to incorporating the latest quieting techniques. At the same time, the Advanced Fleet Reactor will be designed to ensure simpler and more reliable operating characteristics. Although Advanced Fleet Reactor work involves almost all technical areas. the bulk of the effort is reactor development work. Specifically, Advanced Fleet Reactor work in FY 1986 includes: completing critical experiments and final nuclear design; continuing fuel and poison element production for the prototype core; initiating control rod preassembly and preproduction; and designing and fabricating test models, instrumentation, and prototype and test components.

Other Reactor Development work in FY 1986 will include: initial vendor development for fabrication of the Developmental Materials Core; completion of the Submarine Test Core; development of advanced plant concepts; examination of expended cores and irradiated test specimens; evaluation of material corrosion behavior; continued development of the Modified Fuel Process; continued qualification of noise and vibration design procedures; and testing of prototypic components.

CAPITAL EQUIPMENT

Capital equipment requirements for Fiscal Year 1986 include upgrading and replacement of antiquated operating equipment, modifications to prototype systems, additional computing equipment and prototype instrumentation and control equipment. Improved and replacement laboratory equipment, components, and systems are required to continue advanced development and reliable test operations. New computer equipment will replace obsolete equipment and provide up-to-date capability for use in the design and development of advanced reactor plants.

CONSTRUCTION

In Fiscal Year 1986, major construction funds are requested for final funding of two projects: the Modifications and Additions to Prototype Facilities, project number

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81-T-112, which provides for modifying and adding engineered control features to several prototype plants; and the Materials Facility, project number 82-N-111, which will provide a second source for the manufacture of naval nuclear fuel. The FY 1986 budget also includes initial funding of Reactor Modifications to Advanced Test Reactor (ATR), project number 86-N-104, which will provide for the upgrade of systems critical to the reactor's operation, including the replacement and refurbishment of systems in the control room.

PLANT DEVELOPMENT

Plant Development aims at improving overall propulsion plant performance. The overall performance of a nuclear propulsion plant is dependent upon the combined capabilities of all systems, equipment and components in the plant and not just the reactor. Therefore, to fully benefit from the gains in reactor performance, corresponding improvements must be made to all other plant components and systems.

To ensure that a reactor plant is both reliable and safe, a thorough understanding of structural materials corrosion and stress parameters is necessary. New materials and materials used in existing plants are tested and evaluated in special facilities and prototypes. Recognizing that water chemistry is a major factor in corrosion, work continues to develop a fluid environment that minimizes material corrosion and crud buildup.

In FY 1986, Naval Reactors will continue Plant Development efforts, including: developing the next generation of instrumentation, control and electrical equipment; developing, testing and evaluating reactor plant components and component materials; developing and testing alternate chemistries to minimize corrosion of secondary plant materials; upgrading casualty control systems; designing, testing and qualifying advanced system concepts; and operating multi-purpose test facilities for use in evaluating new materials and improving plant performance.

REACTOR OPERATION AND EVALUATION

Reactor Operation and Evaluation encompasses the operation of eight prototype naval nuclear propulsion plants and associated testing and evaluation. These plants serve a number of purposes. First and foremost among them is the testing of developmental cores, components, and plant systems in an actual prototypic operating environment. The prototype plants allow operational testing prior to introduction into fleet service and provide experience ahead of equipment installed in the fleet. Experimental concepts are also tested.

The information gained from prototype operation is used to confirm design specifications and parameters, and when discrepancies appear, to evaluate and aid in resolution of any matter warranting attention. Even after a plant, component, system, or core is introduced into the fleet, it will continue to be tested in a prototype. Equipment is followed until the end of its service life to determine actual end-of-life performance. Life cycle testing is an important consideration in view of the long life of reactor cores and plants. All prototype plants are fully instrumented to provide data needed to evaluate reactor plant equipment. Accelerated life tests carried out prior to committing a new plant, core, component or system to service, serve a useful purpose, but are at best approximations, and do not substitute for operating in a normal manner over an actual lifetime.

As with any operating machinery, the prototype plants must be serviced. Servicing includes routine maintenance, refueling, component removal and replacement, and plant and systems overhaul. The techniques and devices used and refined in prototype servicing operations provide a place to try out new servicing techniques and equipment and serve as the guide for carrying out fleet servicing work.

For FY 1986, Reactor Operation and Evaluation work will include: operation, testing and routine maintenance of the prototype plants; completion of the S5G prototype plant overhaul and refueling; completion of the D1G prototype plant interim inspection and overhaul; performance of an overhaul on both A1W prototype plants; preparation for the S3G prototype plant overhaul and refueling; completion of the S5G prototype plant overhaul and refueling; performance of an extended maintenance shutdown on the S1W plant; continued preparation and development of reactor servicing procedures, techniques, and equipment; and application of these procedures, techniques, and equipment to fleet servicing activities.

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PROGRAM DIRECTION

Program Direction provides for salaries, benefits, travel and other expenses for 213 full time Federal employees at the Naval Reactors, Pittsburgh Naval Reactors, and Schenectady Naval Reactors Offices.

The Naval Reactors Development program has cradle-to-grave responsibility for all aspects of nuclear propulsion. That responsibility increases in proportion to the growing number of nuclear powered ships. Naval Reactors personnel maintain close program management and technical direction of all the varied program activities.

Naval Reactors staffing is austere. Through careful management, the existing manning level has been able to accommodate changing workscopes and increasing demand. Improvements in work force productivity have been achieved over the years, despite increasing workload, by effective use of available staff.

PREPARED STATEMENT OF ROBERT L. MCCRORY, DIRECTOR, LABORATORY FOR LASER ENERGETICS, UNIVERSITY OF ROCHESTER, ROCHESTER, NY

SUMMARY

The University of Rochester's Laboratory for Laser Energetics (LLE) has completed its original five year agreement with the U.S. Department of Energy (DOE). Rochester was responsible for one of the most important breakthroughs in laser fusion, the development of high-efficiency wavelength tripling. The DOE has executed a new planned $23,468,000 three-year Cooperative Agreement with the University for the LLE (1) to continue research for the Defense Inertial Confinement Fusion program, using the frequency-converted OMEGA laser system, (2) to continue operation of the National Laser Users Facility (NLUF), and (3) to continue to educate students in the fields of fusion, engineering, optics, and physics. In order to continue a level-of-effort program (consistent with FY85), a total authorization (which includes $750,000 for outside users of the NLUF) of $8,514,000 is required.

INTRODUCTION

The Laboratory for Laser Energetics of the University of Rochester occupies a unique position in the U.S. Defense Inertial Fusion Program. Established in 1970 as a center for investigation of intense radiation with matter, the Laboratory has the four-fold mission (a) to conduct basic physics experiments and research in support of the national short-wavelength laser program as well as demonstrating the feasibility of direct-drive laser fusion, (b) to provide graduate and undergraduate training in electro-optics, high-power lasers, high-energy-density physics, plasma physics, and nuclear fusion technology, (c) to operate the National Laser Users Facility, and (d) to conduct research in advanced technology areas related to high-energy-density phenomena.

LLE continues as an inertial fusion facility with significant non-federal funding, too. From its inception through 30 September 1984, more than $52.7 million of industry, university, and state funds have leveraged the $64 million federal investment. In addition to its key role in the U.S. Defense Inertial Fusion Program in laser-matter interaction experiments that support of the national short-wavelength laser effort, LLE is part of the University of Rochester and educates students.

EDUCATION

From its beginning in 1970, LLE has made the education of students one of its most important missions. This LLE mission is unique among the Inertial Fusion Program participants. The students come from departments and colleges within the university. While the largest number of graduate students come from the Institute of Optics and the Department of Mechanical Engineering, students from the Departments of Physics, Chemistry, and Electrical Engineering have been and will continue to be educated at the laboratory.

More than 200 students have received graduate and undergraduate training at LLE. Through June 1984, 41 students received Ph.D. degrees while working at LLE; 22 graduate students are currently engaged in Ph.D. research at the laboratory. Current graduate student research ranges from studies in hydrodynamics and parametric instabilities in plasmas to fundamental studies in nonlinear optics.

Graduates of the UR/LLE program are making significant contributions in a number of national laboratories, in industry, and in the nation's major research universities.

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The laboratory is actively recruiting new students for graduate and postgraduate study and research in areas important to the Defense Inertial Fusion Program and to advanced technology development in general. As a result of a nationwide recruiting effort, more than 1000 responses have been received from potential applicants to the graduate research programs at LLE. Under the recently consummated DOE/LLE three-year Cooperative Research Agreement, LLE plans to increase the number of graduate students supported.

THE UNIVERSITY OF ROCHESTER PROGRAM IN LASER FUSION

The University of Rochester has been involved in fusion research since the mid-1960's. It has pursued an expanded research program in conjunction with industry since 1972 at the Laboratory for Laser Energetics. The U.S. Defense Inertial Fusion Program supports laboratory experiments which will determine the critical physics and engineering issues necessary to determine the scientific feasibility of igniting small fusion fuel masses. Present experimental strategy calls for the use of laboratory drivers to acquire data which will help to unambiguously determine the marginal ignition boundaries for small fuel mass systems. These data are vital to the nation's nuclear weapons physics research, and are also necessary in developing the potential for inertial fusion to become an attractive energy source for the future.

In the early 1970's, the University funded the fusion research effort almost exclusively through its industrial sponsors. As the program evolved from a bench-scale effort to a laboratory scale, the University elected to meet a national goal of laser fusion feasibility research using the joint support of the Federal Government, industry, utilities, the State of New York, and the University of Rochester. Approximately $117 million have been invested in the program since 1972. Approximately 46% of the total has come from non-federal sources. In effect, at Rochester a new and different kind of "national laboratory" has been created.

The fiscal year ending September 1984 (FY84) marked a milestone in the history of the Laboratory for Laser Energetics. It was the fifth year of the initial five-year research contract with the U.S. Department of Energy.

In the five years represented by the DOE/LLE supporting research program, 15,341 shots were recorded by the 24-beam, 12-terawatt OMEGA and one-beam, 1-terawatt GDL laser systems. More than 6000 of these were on-target shots. This represents one of the most extensive data bases on 1054NDnm and 351-nm laser interaction with matter.

The University of Rochester was first to demonstrate and patent the high-efficiency, frequency-tripling process. Dr. Schriever, Director of the U.S. Department of Energy Office of Inertial Fusion has stated: [1]

"In the laser fusion area, the most important breakthrough has been the development of efficient wavelength conversion, now being implemented on Nova and Omega."

The full Omega system is now fully frequency-converted to 351 nm. The Omega system, with its high repetition rate capability and reliability will enable accumulation of crucial data necessary to understand the physics scaling laws of inertial fusion using short-wavelength lasers in a symmetric ("direct-drive") illumination geometry. Understanding the physics scaling laws means we must verify predicted target performance as target size, laser energy, and wavelength are varied. Rochester's critical role in the National Program will minimize the technical risk associated with the Inertial Fusion Program as well as provide an alternative approach to laser fusion.

During the past year several major experimental campaigns were carried out on Omega. These campaigns investigated (a) illumination uniformity, (b) coronal physics, (c) energy transport and ablation, (d) high-Z plasma dynamics, (e) atomic physics and x-ray laser physics, and (f) fusion diagnostic development. A number of these experiments were carried out in collaboration with other inertial fusion laboratories.

The results of these experiments, reported in LLE's FY 1984 Annual Report, [2] give renewed promise for the successful demonstration of direct-drive laser fusion.

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[1] S. HRG. 98-1175, Hearings before the Subcommittee on Energy Research and Development of the Committee on Energy and Natural Resources, United States Senate (March 5, 12, 20, 22, April 5 and 24, 1984), p. 836.

[2] University of Rochester, Laboratory for Laser Energetics Annual Report, DOE/DP/40124-67 (January, 1985).

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Direct drive is an important research tool needed to advance inertial fusion research, and provides a wealth of high-energy-density physics data. Atomic physics, laboratory astrophysics, x-ray laser physics, and x-ray generation are a few of the areas that have benefited from research devoted to understanding the basic physics of laser-matter interaction.

Work at LLE and elsewhere has shown that the illumination uniformity required for high-convergence implosions can be achieved with laser technology already developed. Short-wavelength, laser-matter-interaction experiments have confirmed the expectations of high absorption, low preheat, and high ablation pressure.

The short-term (1- to 3-year) objective of the LLE program is to demonstrate sufficient drive uniformity with the 24-beam OMEGA system at 351 nm to compress targets to densities in excess of 20 g/cm^3. The OMEGA system converted to full 24-beam, 351-nm operation has begun operations at the 2000-J level. It is expected that densities of the order of 10 g/cm^3 can be achieved on Omega by 1986 using gas-filled targets. Improvements in illumination uniformity and cryogenic targets are expected to produce higher densities, of the order of 20 g/cm^3 by mid-1987.

OPERATION OF THE NATIONAL LASER USERS FACILITY

A second unique characteristic of the Rochester program is the National Laser Users Facility (NLUF). Since 1979, 42 proposals have been approved for the facility. In addition to investigations in the general area of inertial fusion, approved experiments have also included investigations in plasma physics, x-ray laser development, XUV spectroscopy, and instrumentation development. Researchers from Brigham Young University, Los Alamos National Laboratory, the National Bureau of Standards, the Naval Research Laboratory, the Goddard Space Flight Center, Physics International, Inc., Polytechnic Institute of New York, University of California (Davis), University of California (Los Angeles), University of Connecticut, University of Illinois, University of Maryland, University of Pennsylvania, University of Texas, and Yale University have participated in NLUF experiments.

PROGRAM FUNDING AND MANAGEMENT

On October 1, 1985, the Department of Energy executed a new three-year Cooperative Agreement with the University of Rochester. The new agreement funds the Laboratory for Laser Energetics at a planned $23,468,000 over three years ($7,428,000 for FY85, $7,764,400 for FY86, and $8,275,600 for FY87). These agreement amounts do not include funds which are provided directly to the NLUF users. The dollar amounts were the result of a series of negotiations with the Department of Energy, the last of which occurred in July, 1984.

The negotiated Agreement with the Department of Energy establishes Rochester's program as a level-of-effort program (consistent with FY85) for FY86 and FY87. The agreement funds 63.6 man-years per year for each of the three years. The equipment funded in FY85 includes $704,000 for the blue conversion. For FY86, equipment purchases are anticipated for replacement parts necessary to operate the system ($695,000), and diagnostic equipment required for the experimental campaigns ($437,000).

In order to operate the newly converted system and conduct the experiments which will produce high densities and temperatures in laser-driven inertial fusion capsules, as well as to continue its mission to educate students and operate the NLUF, LLE requires total funding of $8,514,000 for FY86.

We expect that the laboratory will continue to play an important role in the Inertial Fusion Research Program, in the training of the nation's scientific leaders, and in the development of advanced technology.

PREPARED STATEMENT OF ALEXANDER J. GLASS, PRESIDENT, KMS FUSION, INC.

SUMMARY

The 1986 Administration budget proposal calls for a 60 percent reduction in funding for the Inertial Confinement Fusion (ICF) program. With the Nova facility starting operation, and significant technical progress in the classified portion of the program, we feel that such drastic budget reductions are counterproductive, and will deprive the country of the benefits of the billion-dollar-plus investment made to date in the ICF program. KMS Fusion urges the committee to restore funding for the ICF program to a productive level.

KMS Fusion plays a unique role in the ICF program, as the primary source of classified physics data supporting the Nova experiments program, and as a major

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supplier of target technology. We propose to modify our laser facility, Chroma, to increase our capability to conduct ICF target physics and x-ray laser experiments. This enhancement will provide the program with a low cost, high data-rate facility for physics data, and will free up the $180 million Nova facility for the high-value ICF and weapons physics experiments for which it is uniquely suited. KMS Fusion requests a 1986 budget of $15 million in operating funds, and $4.6 million in capital equipment, to carry out the proposed facility modification, while continuing our research program.

THE INERTIAL FUSION PROGRAM

Fusion is the process which generates the sun's radiant energy, and which gives the hydrogen bomb its awesome power. In fusion, the fuel, consisting of the heavy isotopes of hydrogen (deuterium and tritium), is heated to a temperature of 100 million degrees, hotter than the sun's interior. At this temperature, the hydrogen nuclei fuse together to form helium, with an attendant release of energy. The fuel must be confined, i.e., held together long enough so that the energy released exceeds the energy invested to heat the fuel to the reaction temperature.

Inertial Confinement Fusion (ICF) is one approach to confining and heating fusion fuel. Energy from a powerful laser or particle beam is concentrated on a spherical shell containing the fuel. The fuel is heated and compressed in the process, until thermonuclear conditions are achieved at the center, igniting the fusion reaction. The surrounding compressed fuel is then ignited by a propagating thermonuclear burn wave, releasing energy from the fusion reaction.

Inertial Fusion research has been supported by the Congress for over a decade, with two objectives. In the near term, the ICF program provides information about thermonuclear physics which is of vital importance to the nuclear weapons program. In the long term, ICF is viewed as an alternative path to harnessing fusion as a source of energy. In the Department of Energy, the ICF program is administered by the Office of Inertial Fusion, under the overall direction of the Assistant Secretary for Defense Programs.

The hydrogen bomb demonstrates that inertial fusion is feasible on a large scale. The objective of the ICF program is to demonstrate that thermonuclear ignition can be achieved on a laboratory scale, driven by a laser or particle beam. The ICF program has constructed three major facilities to assess the feasibility of inertial fusion. These are Antares, a 40 kilojoule carbon dioxide laser at the Los Alamos National Laboratory, Nova, a neodymium-glass laser producing 100 kilojoules of infrared light, at the Lawrence Livermore National Laboratory, and PBFA-II, a light-ion beam facility currently nearing completion at the Sandia National Laboratory.

Last year, Congress called for a high-level review of the ICF program by the administration. A prestigious panel of scientists has been assembled, under the auspices of the National Academy of Sciences, to conduct this review. They met here in Washington early in March, and heard presentations from the Office of Inertial Fusion, and from each of the six participating laboratories. The panel will visit each of the ICF laboratories in the weeks to come. The NAS review committee is scheduled to submit an interim report this summer, and a final report by February 1986.

THE NOVA PROJECT

In 1979, the Department of Energy approved the construction of the Nova laser at LLNL. Nova was originally conceived as a 20-beam, neodymium-glass laser, capable of generating 200-300 kilojoules of infrared light in three-billionths of a second (3 nanoseconds). However, DOE only approved construction of a ten-beam system, designed to produce 100 kilojoules of infrared light, but with frequency conversion capability, to convert the output to visible light. The total project cost for Nova is approximately $180 million. Nova can operate either with two beams or ten, and is equipped with two experimental target chambers.

There are two basic approaches to driving an inertial fusion target. The laser light can impinge directly on the target (direct drive), or can be converted to x-rays in an enclosure ("hohlraum") containing the fuel mass, and the x-rays used to drive the target (radiation drive). Radiation-driven targets offer better uniformity of illumination than direct-drive targets, but sacrifice efficiency at lower laser energies. Both approaches are currently under investigation in the ICF program. Nova experiments will emphasize the radiation-driven approach, which also provides important information on the physics of nuclear weapons.

In order to ignite the fusion reaction, it is necessary to heat the fuel to 100 million degrees, and to compress it to 1000 times the density of liquid hydrogen (1000 × L.D.). Nova experiments are unlikely to achieve both conditions simultaneously.

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However, it is expected that targets will be compressed to 500 × L.D. in the first year of Nova's operation, at a temperature lower than that required for ignition. Subsequent Nova experiments are expected to achieve 1000 × L.D., at sub-ignition temperatures. Data from the Nova experiments, taken together with information obtained from other sources in the program, will define the driver and target requirements for both ignition and high-gain targets. These experiments will thus provide the basis for evaluating the applicability of ICF to both its military and energy objectives, in the 1986–1987 time frame.

KMS FUSION'S CONTRIBUTIONS TO THE ICF PROGRAM

KMS Fusion is located in Ann Arbor, Michigan, and is the only private participant in the ICF program. KMS Fusion has played a major role in the development of inertial fusion. The company began fusion research in 1971. Ten years ago, the world's first successful demonstration of laser-produced thermonuclear reactions took place at KMS Fusion's laboratory, in Ann Arbor, Michigan. Since then, the company has contributed many other innovative "firsts" to the program. KMS Fusion was the first to carry out experiments with short wavelength light, a technique which has been subsequently adopted world-wide. The company pioneered the use of frozen (cryogenic) fuel in ICF targets, a complex technique generally acknowledged to lead to improved target performance. Until 1983, when LLNL conducted its first cryogenic target series, KMS Fusion was the only laboratory in the world to carry out cryogenic experiments. KMSF scientists had demonstrated, in 1981, that cryogenic targets perform better than gas-filled targets. Most recently, in 1983, the company developed a multi-frame holographic interferometer for visualizing the evolution of material surrounding the surface of a target. This instrument is capable of providing stop-motion images in a fifty-billionth of a second. Up to four such images can be recorded during each experiment, which lasts less than a billionth of a second.

The company is a major supplier of targets and target components within the ICF program. The target fabrication effort comprises roughly half of the company's activities. This effort supports the internal research program at KMS Fusion, and also produces target materials and components for the other participants in the program. Several European laboratories also buy the submillimeter-sized glass Microshell® fuel containers that KMS Fusion has developed for fusion use. In addition to target fabrication, the company is pursuing long-term research to develop the large targets needed for the critical experiments to be performed on Nova. These targets involve several techniques and technologies developed at KMS Fusion, including cryogenic fuel, and various new target materials.

In addition to the company's efforts in material science and target fabrication, KMS Fusion operates a highly productive experimental facility, the Chroma laser. Chroma is a two-beam laser, capable of producing up to 800 joules of infrared light in a pulse of one billionth of a second duration. This energy can be efficiently converted to visible light, which couples more effectively to the fusion target. The laser is equipped with a pulse stacker, which allows us to synthesize pulses of arbitrary temporal shape, an important parameter for optimal target compression. The Chroma laser is outfitted with three experimental areas. This allows us to carry out one set of experiments, while setting up other experimental configurations. At present, one experimental area is devoted to a unique optical system, devised and patented by KMS Fusion, which enables us to illuminate a target uniformly from all directions, using the light from the two beams of Chroma. Either gas-filled or cryogenic targets can be imploded in this target chamber. The other experimental areas are used to explore the physics of radiation-driven targets, and to conduct other experiments on laser-matter interaction.

KMS FUSION'S UNIQUE ROLE IN THE ICF PROGRAM

In 1979, KMS Fusion was designated as a support laboratory for glass laser experiments, and since then, its efforts have been closely coordinated with those of the lead laboratory for glass laser experiments, LLNL. About 850 experiments were carried out on the Chroma laser facility in 1984. KMS Fusion is the only laboratory other than LLNL conducting glass laser experiments on radiation-driven targets. With its highly flexible experimental facilities, operating at a high data rate, and backed up by a full spectrum of capabilities in data analysis, target design, target fabrication and diagnostic instrumentation, KMS Fusion has emerged as the primary source of supporting physics data for the "flagship" facilities at LLNL, Nova, and its predecessor, Novette.

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Experiments are carried out at KMS Fusion by our scientific staff, often with the involvement of researchers from LLNL and other laboratories. Over the last two years, LLNL-KMSF teams have conducted experiments on the use of x-ray spectroscopy to diagnose the density and temperature of target plasmas, the effect of classified target construction on hot electron generation, and the characterization of x-ray sources used for target analysis. In preparation for the historic experiments conducted at LLNL last year, which demonstrated soft-x-ray laser action for the first time, joint LLNL-KMSF-NRL experiments were conducted on the Chroma facility to establish which candidate materials were most likely to succeed in an x-ray laser experiment, and how the plasma cloud surrounding the target would evolve. Our internal research program is also directed toward providing the physics and technology data base required for the proposed Nova experiments. During the past two years, we have measured the transport of energy in target plasmas, using spherical illumination, which creates nearly one-dimensional target conditions which are much more readily analyzed; and we have developed and applied novel diagnostic techniques to measure the distribution of energy and the occurrence of deleterious plasma processes in hohlraum targets. We have continued to pioneer the development of cryogenic targets, and have recently solved the difficult problem of stabilizing a uniform layer of liquid D-T in a large, Nova-sized target.

KMS Fusion maintains a small effort on the development of the Oxygen-Iodine laser. If energy can be extracted from that laser efficiently in a short pulse, it could provide the required combination of short wavelength, high repetition rate and high efficiency required for all ICF applications. Over the past two years, we have received support for further development of this laser from NASA, and the Air Force Weapons Laboratory.

We requested funds in FY 1985 to initiate the design and construction by KMS Fusion of a cryogenic target facility for the University of Rochester. During the summer of 1984, the University of Rochester asked us to accelerate that project, to allow us to deliver the finished target assembly to them early in Calendar Year 1986. By redirecting a portion of our program funds, we were able to satisfy their request. Our cryogenic technology will be installed on the Omega laser facility at the University of Rochester during the first quarter of 1986, and will be ready for operation at that time.

KMS FUSION'S 1985 BUDGET REQUEST

As in previous years, all the participants in the ICF program look to Congress to restore program funds deleted in the Administration's budget request. At the $70 million level proposed by the Administration, we cannot operate the facilities that exist in the program, and therefore cannot progress toward the program goals. It is doubly ironic that we are confronted by the spectre of a disastrous budget cut just as the Nova facility starts operation, and as the National Academy's review committee starts its deliberations. For several years, KMS Fusion has testified before Congress that a modest increase in KMS Fusion's funding would enhance the productivity and cost-effectiveness of the ICF program, especially in the use of its premier facility, Nova. As we have noted in this testimony, our facility, with its flexibility, full spectrum of supporting services, high data rate and low operating cost, is ideal for conducting those experiments which do not require the full capability of the facilities at the national laboratories, but which provide the data base needed to ensure the success of the high-value experiments carried out on the large facilities.

In 1986, we are proposing to modify our laser, Chroma, to increase its output from its current level of 500 joules of visible light to 2500 joules, in a one nanosecond pulse. We have provided the committee with a detailed proposal for this modification, which is a classified document. We request that our proposal, which has been submitted to the committee staff, be incorporated into the record. This modification will entail a one-time capital cost of $4.6 million. In addition, we are requesting operating funds of $15 million.

We feel that this modification is extremely important in view of the climate of cost consciousness which surrounds these hearings. The modified Chroma laser would continue to operate at a shot rate of 6–10 shots per day, with only minor increases in operating costs. At a rate of 850 shots per year (our actual 1984 shot rate), and a five-year lifetime, with an operating cost estimated to be $4 million per year, the total cost of an experiment on the modified Chroma will be about six thousand dollars. For the sake of comparison, the corresponding figure for a Nova shot will be over $200 thousand.

Of course, Nova will produce twenty times the energy of the modified Chroma. As a result, LLNL will be able to carry out experiments which cannot be conducted on

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any other facility. These must be high-value experiments in target implosion physics, weapons physics, and weapons effects. In our classified proposal, we show that many of the supporting experiments involving energy transport, laser-plasma interactions, and x-ray laser development can be carried out on Chroma at far lower cost, making Nova available for those experiments to which it is uniquely suited.

We propose to continue operating Chroma while the modification is underway. We do not expect the changeover to the modified system to interrupt our experimental schedule for more than about one month. We shall continue our work on target fabrication, supplying targets and target components to the other laboratories in the program, on diagnostic development, and on the development of the Oxygen-Iodine laser.

In a period of heightened cost-consciousness, the true measure of economy lies in enhanced productivity. Cutting the program funding in half is disastrous, because it reduces the productivity to zero. The funding level which we request will truly be cost-effective, both by increasing the utility of the KMS Fusion facility, and by enhancing the productivity and availability of the Nova laser.

Senator BINGAMAN. Some of the Members have questions which will be submitted for the hearing record. Your response will be deeply appreciated.

[Questions with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR JOHN WARNER

INERTIAL CONFINEMENT FUSION

Senator WARNER. Mr. Hoover, I noted with considerable interest that the request for the ICF program is much lower than anticipated. Can you comment on the rationale for the reduction? How does the reduction square with the considerable investment in ICF-related facilities that has been made over the last several years? Does this reduction prejudge the findings of the panel that is now meeting at the direction of Congress to consider the future of the ICF program?

Mr. HOOVER. We recognized, as did the Congress in its authorization of a review group on ICF, that the process would take a year to complete. Meanwhile, we had to bring forward a budget request and established that approximately $70 million for ICF in FY 1986 is consistent with our priorities for weapons research and development. I have asked the national laboratory directors to provide their recommendations for whatever additional priority experiments can and should be accomplished using the large ICF facilities at those laboratories. I expect the ICF Review Group's judgements on the technical status of ICF and its potential for weapons research and development support over the near term to allow us to set the appropriate level of ICF funding in future years within our overall weapons research and development priorities.

Senator WARNER. Dr. Batzel, Dr. Kerr, and Dr. Dacey, would you care to comment on the impact of the Inertial Confinement Fusion (ICF) reduction at your laboratory?

Dr. BATZEL. The reduction in the ICF program at Lawrence Livermore National Laboratory from $68.2 million in FY 1985 to a current allocation for FY 1986 of $23.5 million would result in a loss of 250 full-time equivalents of direct effort, as well as associated indirect support. This is a 66 percent reduction in funding and would have a dramatic effect on the progress of the national program and on its key scientific staff. Most of the major results in the national ICF program have been achieved at Livermore. Now with NOVA soon to be operational, we will have the only national facility capable of accessing the physical conditions necessary to study a broad range of weapons physics and fusion reactor issues. The impact of so large a reduction in funding reaches beyond the operation of NOVA, however. It could take years to recover from the effects of so large a reduction in scientific staff. This, in turn, would impact our nuclear weapons program, since scientists trained in the ICF program become a unique source of talent for weapons physics as well.

Dr. KERR. The sudden reduction in funding for ICF at Los Alamos National Laboratory from the current $41.5 million to $21.8 million would deal a severe blow to the ongoing research conducted by excellent scientific teams that have been carefully assembled over the past fourteen years. Staffing would be reduced from the current 232 full-time equivalent scientific staff to 120, a loss of more than 110 well-qualified personnel. The total reduction is even greater than 110, since support personnel for the 110 scientific staff would also be reduced.

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Since we consider capsule physics issues to be the element of greatest importance to both ICF and the laboratory nuclear weapons program, we would attempt to continue theoretical and experimental efforts in this area. The rapid rate of progress we have been able to sustain over the past several years would, however, be slowed.

The remaining activities which we would continue to support, at reduced levels, would be those technology base activities which have been built up and supported by the ICF program and which have the greatest overlap with other laboratory weapons programs. At the proposed funding level, it is unlikely that the laboratory could find additional resources to continue to have an integrated ICF program. [Deleted.]

Dr. DACEY. Inertial Confinement Fusion has been a very large project during the past ten years and has resulted in the construction of major facilities at Lawrence Livermore National Laboratory, Los Alamos National Laboratory, and Sandia National Laboratories. The program was originally intended as a response to the energy crisis; however, the crisis is no longer perceived as a national imperative so these programs now exist primarily for the benefit of the weapons program. The facilities are being used effectively for research in strategic defense, nuclear weapon physics, nuclear weapon effects, and Inertial Confinement Fusion. By including inertial fusion with the research, development, and testing funds, each laboratory will have the opportunity to determine the appropriate balance. The total requested funds for research, development, and testing, including Inertial Confinement Fusion, have not decreased appreciably. Since the funds for inertial fusion are to be determined by the laboratories, this budget request does not necessarily constitute a reduction in the inertial fusion effort and does not pre-judge the findings of the panel.

Sandia National Laboratories believes that the determination of the balance between inertial fusion and the other pressing needs of the research, development, and testing program can best be done at the laboratory level. It is regretable that, due to the tight budgetary constraints, the total package of research, development, and testing, with Inertial Confinement Fusion included, is less than required for the many demands on those funds. To prioritize the funds, the level of funding of our Inertial Confinement Fusion program within the President's budget will have to be determined by the appropriate Sandia review committee. The committee will consider the recent successes in the Sandia portion of the Inertial Confinement Fusion program on the Proto I and Particle Beam Fusion Accelerator-I accelerators which indicate that Particle Beam Fusion Accelerator-II will be a very useful fusion experiment. We anticipate that the cost effectiveness of the Sandia approach and its promise for weapons physics, strategic defense research, weapon effect simulations, and long-term energy production will justify continuing a strong program at Sandia.

STOCKPILE MEMORANDUM

Senator WARNER. Dr. Wagner, what assumptions are made in the stockpile memorandum with respect to continued compliance with existing arms control agreements? What does the Department intend to do with the Poseidon warheads that might be made available by earlier than planned retirement of Poseidon submarines?

Dr. WAGNER. There is no direct correlation between the stockpile memorandum and existing arms control agreements which limit either launcher, in the case of SALT II, or system deployment, in the case of the ABM Treaty; neither place limits on the number of warheads in the stockpile.

A national decision has not yet been made concerning future U.S. actions with respect to the early retirement of Poseidon submarines to comply with the unratified SALT II Treaty. In keeping with the President's direction, all options are being kept open. The Secretary of Defense has directed that planning be accomplished to ensure that launcher dismantlement options, involving Navy aspects, are attainable if a decision is made to continue the present "no undercut" policy. Until such a decision, the [deleted]. It is worthwhile to note that, when Soviet SLBM launchers are dismantled, we have no indication what actions are taken with their associated nuclear warheads.

SPECIAL ISOTOPE SEPARATION

Senator WARNER. Mr. Hoover, can you address the need for the Department's Special Isotope Separation (SIS) program, and provide for the Committee the Department's current plans for deployment of SIS capabilities?

Mr. HOOVER. When deployed in the early 1990's, plutonium special isotope separation would be used by the Department of Energy to separate weapon-grade plutoni-

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um for defense programs from government-owned fuel-grade plutonium. This capability would also provide: greater flexibility if problems should develop with current or planned material production operations; the ability to respond rapidly to potential increased defense programs demands for plutonium; and the technology to clean up weapon-grade plutonium even further to reduce radiation exposures to weapons production and deployment personnel.

In fiscal year 1984, the Lawrence Livermore National Laboratory utilized the Atomic Vapor Laser Isotope Separation process to successfully demonstrate single plutonium isotope separation in a plant scale prototypic separator at projected production rates. Based on these results and recent plutonium laser isotope separation technology assessments, we are proceeding with plans for deployment of a special isotope separation production capability in the early 1990's. This schedule, if approved and funded, would be consistent with the projected need for isotope separation contribution to weapon-grade plutonium supplies.

SPECIAL ISOTOPE SEPARATION

Senator WARNER. Dr. Batzel and Dr Kerr, what is the status of SIS activities at your Laboratory, and what are your views with regard to the strategy outlined by Mr. Hoover?

Dr. BATZEL. The SIS Program at LLNL has demonstrated single PU isotope separation [deleted] with developmental hardware. To date in test runs, we have separated plutonium-240 from fuel-grade plutonium feed to produce [deleted] of plutonium-239 enriched product. What remains to be done is to build a separator pod and laser system that are fully prototypical of what we will build for the plant at Hanford and thoroughly test them here at LLNL. This activity can be completed by the end of FY 1986 with appropriate support. At that point, DOE will be ready to proceed with construction of the full SIS plant at Hanford.

Dr. KERR. The plutonium isotope separation program at Los Alamos National Laboratory is nearing the completion of an enrichment facility (SIS-III) that will meet the Laboratory's needs for special isotopes of plutonium [deleted]. This facility has been built at minimum cost by utilizing existing plutonium-qualified space. The installation of lasers and support hardware is 70 percent complete and initial operation is scheduled for September 1985.

During the past year, major scientific and engineering advancements were achieved. The Los Alamos process has already demonstrated a greater enrichment of plutonium isotopes than any other known process. The most noteworthy new development was the successful testing of a high average-power solid-state laser that is utilized in the first step of our plutonium enrichment process. The laser unit is [deleted] represents the world's highest average power-turnable solid-state laser. The laser was developed in a modular form so that simple replication of modules would allow us to scale to higher production rates, if required by DOE. Another scientific milestone was the development [deleted] which successfully converts all plutonium fluorides to volatile PuF_6 [deleted].

It is our understanding that the Los Alamos SIS-III facility is an integral portion of the DOE's strategy for continuing a vigorous weapons development program and providing a backup capability for processing weapon-grade plutonium. When completed, SIS-III will be utilized to produce [deleted] special plutonium isotopes in support of the Los Alamos weapons program.

STRATEGIC DEFENSE INITIATIVE

Senator WARNER. Mr. Hoover, can you describe the Department's Strategic Defense Initiative-related activities in view of the focus of the overall Strategic Defense Initiative program on nonnuclear approaches to strategic defense?

Mr. HOOVER. The Department continues to pursue research primarily aimed at assessing the technical feasibility of nuclear-driven directed energy weapons. Our program also includes vulnerability/lethality efforts, systems studies, and Strategic Defense Initiative-related nuclear power research.

The Secretary of Defense and Secretary of Energy recently signed a joint policy statement which clarifies the role of nuclear research in regard to the Strategic Defense Initiative. It emphasizes that, although the long term goal of Strategic Defense Initiative is a truly effective nonnuclear defense, there are a variety of reasons for including nuclear research in the Strategic Defense Initiative program. They are:

(1) to determine the feasibility and effectiveness of counterdefensive nuclear-driven systems that an adversary may develop for use against future United States surveillance and defensive systems;

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(2) to understand the technical feasibility and impact that such concepts might have on our deterrent forces if utilized in Soviet defensive systems; and
(3) to explore nuclear directed energy options as United States Strategic Defense Initiative possibilities, if needed.

STRATEGIC DEFENSE INITIATIVE FUNDING

Senator WARNER. Dr. Batzel, Dr. Kerr, and Dr. Dacey, the impression left by some of the budget materials with regard to SDI research is that funding for these technologies originated with the President's initiative. Can you put SDI-related activities at your laboratory in perspective, so that the committee might appreciate the funding trends associated with these technologies?

Dr. BATZEL. An experimental program in the advanced nuclear-directed energy concepts at Livermore was well established long before the President made his speech on strategic defense. That work was undertaken some six or seven years ago to learn what might be possible, for this nation as well as for our adversaries.

The National Strategic Defense Initiative effort is funded at about $1.4 billion in FY 1985 not including about $210 million in the Department of Energy which is for nuclear-directed energy concepts. So, about 10 percent or 15 percent of the national effort on Strategic Defense Initiative is nuclear related.

Dr. KERR. The evaluation of potential defense against ballistic missiles has been a long-term responsibility of the laboratory spanning at least 25 years. It is difficult to give a precise number for funding in the early years; however, the activity was large during the 1960s with the Safeguard and Spartan evaluations. For the last ten years, SDI technology developments have comprised about 10 percent of the Los Alamos technology base activities under the Department of Energy research, development, and testing funding. The steady nature of this funding can be seen in the attached chart presented during the hearings. Since 1983, we have allocated additional resources to this effort from growth in the Department of Energy research, development, and testing funds so that in FY 1985 the Los Alamos SDI effort for the Department of Energy is [deleted] of the weapons program funding at Los Alamos National Laboratory.

Specific impacts of the proposed budget are:

1. Reduction in scientific staff from 232 to 120 FTE's.
2. Slow-down of the capsule physics program with an indefinite delay in addressing a key technical issue for achieving high-gain, small-capsule performance. [Deleted.]
3. Severe curtailment (by more than one-third) in technology base activities supporting ICF and the laboratory weapons program in the areas of: materials science and technology, diagnostics development, laser physics and technology, plasma physics, and implosion system design.
4. Elimination of advanced excimer laser development addressing large system issues for both ICF and strategic defense initiative applications.
5. Elimination of all driver-target interaction experiments either with lasers or particle beams (at Sandia National Laboratories).
6. Elimination of all systems and applications efforts.

Congress should be aware that a reduction of this magnitude would result in elimination of the ICF program before it has had the opportunity to address even its scientific goal, and at a time when the program is showing its greatest progress.

Dr. DACEY. Research on defensive technologies at Sandia has consisted of major programs in directed-energy weapons, systems studies, threat evaluation, and countermeasures for many years. The Strategic Defense Initiative focused these programs and encouraged our scientists to come up with new research efforts to complement the existing ones. In general, the existing efforts have stayed level or slightly increased in FY 1985 as the basic technologies developed in our technology base program were applied to new concepts. The number of new concepts that are being examined seems to be increasing rapidly and we are seriously critiquing them to choose which ones are most promising. Expansion of the Strategic Defense Initiative related work has been accomplished at the expense of technology base activities for our more traditional nuclear weapon research. We anticipate a 30 percent increase in our Department of Energy/Strategic Defense Initiative programs in FY 1986 to fund these new projects. We intend to fulfill the Department of Energy/Strategic Defense Initiative plan in FY 1986 and beyond.

NEW STARTS

Senator WARNER: Mr. Hoover, the committee will be looking very carefully at new starts this year in view of expected budget constraints. Can you highlight for

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the committee the new starts in each of the major areas of the Defense Programs request?

Mr. HOOVER: I would be happy to provide for the record a listing of new starts by major program areas. The information follows:

PROGRAM COMPONENT/PROJECT TITLE

[In millions of dollars]

	Total estimated cost	Fiscal year 1988 request
Weapons production and surveillance:		
General plant projects, various locations	33.7	33.7
Structural upgrade of existing plutonium facilities, Rocky Flats	7.5	3.0
Environmental hazards elimination, various locations	39.0	8.7
Safeguards and site security upgrading, phase II, Mound Laboratory	5.0	3.0
Safeguards and site security upgrading, phase II, Pantex	10.0	1.5
Tritium loading facility replacement, Savannah River	120.0	5.0
Subtotal	——	54.9
Weapons research, development, and testing:		
General plant projects, various locations	29.9	29.9
Decontamination and waste treatment facility, Lawrence Livermore National Laboratory	11.6	1.0
Strategic defenses facility, Sandia National Laboratories	70.0	8.0
Subtotal	——	38.9
Materials production:		
General plant projects, various locations	34.8	34.8
Productivity retention program, phase I, various locations	201.5	27.2
In-core neutron monitoring system, N reactor, Richland	7.6	5.5
Purex electrical system upgrade, Richland	8.3	3.5
Additional line III furnace, Savannah River	16.0	2.0
Reactor electrical distribution system, Savannah River	22.6	4.0
Effluent treatment facility, Savannah River	55.0	2.5
Plantwide safeguards systems, Savannah River	10.0	2.2
Hydrofluorination system, FB-line, Savannah River	10.0	2.2
Subtotal	——	83.9
Defense waste and byproducts management:		
General plant projects, various locations	26.5	26.5
B plant F filter, Richland	4.0	1.0
Central waste disposal facility, Oak Ridge	1.0	1.0
Low-level waste processing and shipping system, Fernald	17.0	2.5
INEL security upgrade, Idaho	10.0	2.0
Subtotal	——	33.0
Nuclear safeguards and security:		
Nuclear safeguards and technology laboratory, Los Alamos	10.6	1.0
Grand total, new starts	——	211.7

WEAPONS COST

Senator WARNER. Mr. Hoover, the committee has been very interested in controlling the costs associated with our weapons systems to include the nuclear warhead. Can you highlight for the committee the extent to which changes in the unit costs of weapons have changed from last year to this, and whether these changes are attributed to factors within the Department of Energy or to external factors such as environmental issues or congressional actions?

Mr. HOOVER. Last year we provided life cycle cost information for ten systems. In terms of direct per unit production cost, six of the ten systems are reflecting increases over last year's estimates, three of the ten are showing decreases, and one system the W85 Pershing II warhead, is unchanged.

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With regard to the six systems reflecting increased estimates, three are showing relatively small increases. [Deleted.] The increases on these systems are attributable to design or production process changes.

The system with the greatest increase in its per unit production cost estimate is the W79 warhead for the 8-inch artillery fired atomic projectile. [Deleted.]

Ninety percent of this increase is the result of the decision to limit the total production of modern artillery fired atomic projectiles to a total of 925 units. This limitation was laid down in Section 1635 of the FY 1985 Defense Authorization Act. [Deleted.] This reduction has an impact on unit costs because certain fixed front-end production costs such as tooling, production engineering, and process engineering are spread over a reduced production quantity.

[Deleted.]

As I stated earlier, we have three systems reflecting production unit cost decreases from last year's estimates. [Deleted.]

PROGRAM DIRECTION

Senator WARNER. Mr. Hoover, what accounts for the significant growth in the Program Direction cost component of your request?

Mr. HOOVER. This increase may be attributed to a recent decision by the Department to terminate the Community Assistance Program as it pertains to the City of Oak Ridge and Counties of Roane and Anderson in Tennessee. This termination will be accomplished with a lump-sum payment of $41.1 million. This results in an increment of $35 million for FY 1986. These funds will assist the communities in attaining their goal of financial independence in a more timely manner.

BUDGET PRIORITIES

Senator WARNER. Mr. Hoover and Dr. Wagner, it is likely that the committee will have to consider reductions in the program before us in view of budget constraints. Can you gentlemen provide the committee with your counsel regarding the general funding priorities that should guide our efforts in this regard? What are the effects of budget levels constrained to the FY 1985 budget authority levels adjusted for inflation?

Mr. HOOVER. From the very first stages of developing the FY 1986 budget request, we have been under an Administration mandate to include only carefully considered increases in this submission. From the start, a concept of constraint was built into our funding requirements. Accordingly, all Defense Programs funding proposals were carefully examined within DOE and by the Administration to assure that no discretionary funding was included and that our increases were held to less than those proposed in previous years. This year we are requesting a total increase of about nine percent over FY 1985; however, our real program growth only amounts to about two percent over last year. The difference of seven percent reflects an adjustment of five percent for inflation and two percent for nonprogrammatic, operational support-type activities that are not directly associated with the production of nuclear weapons. These activities include: requirements to pay state taxes, safeguards and security, upgrades, environmental improvements, and the addition of other costs to our budget such as the cost of enriched uranium needed for the nuclear Navy. These types of activities have been gradually increasing over the past few years to the point where they make up about 15 percent of our total FY 1986 request. If our funding authority is constrained to the FY 1985 level adjusted for inflation, it would severely impact our ability to successfully carry out the priority program activities described below.

When viewing Defense Programs funding priorities from a broad perspective, it is important to point out that each year our operational requirements are for the most part driven by production guidance contained in the Annual Nuclear Weapons Stockpile Memorandum (NWSM). We work closely with the Department of Defense to develop the production schedule for new weapons and the retirement of older systems. Each year when the President signs the NWSM, he gives us production and retirement approval for the budget year plus four years. Our first priority in any budget year then is geared toward meeting these predetermined workload schedules. Above all, we have to meet our production schedules.

To assure that the technical knowledge is available to produce warheads on schedule and within costs, we need to continue to develop a strong research and development effort. To this end, our goal is to employ approximately 9,100 full-time equivalent laboratory employees in FY 1986. A strong and viable research and development program depends on hiring the best and brightest laboratory employees available, and we need to continue to revitalize our facilities, not only to continue our

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technical superiority, but also to attract the best people to work in our laboratories. Further, it is vitally important that we continue to maintain and restore our production plants so that our weapons and material production facilities continue to operate effectively and efficiently and at a capacity necessary to maintain required operational schedules. Finally, we want to continue to make progress on our commitment to assure that facilities and materials are secure and safe from potential adversary actions and that environmental and safety concerns are quickly detected and corrected in a responsible and cost-efficient manner.

Dr. WAGNER. The attached charts provide comparisons (and contrasts) between Department of Defense (DOD) and Department of Energy (DOE) funding for various portions of the nuclear component of our defense posture; each chart has been normalized, using FY 1977–79 as the base, and examines fractional real growth since that time, using constant FY 1985 dollars throughout.

The first chart compares the nuclear system procurement costs for the two Departments; the DOE procurement consists of both the production and surveillance costs as well as the nuclear materials production costs. Not surprisingly, the two Departments are consistent; although this is a very broad brush overview, one would expect similar changes in procurement for both nuclear systems and the associated warheads.

The second chart, however, shows an alarming disparity in the associated nuclear research and development between the two Departments. The DOD nuclear RDT&E has kept pace with procurement, with both growing by roughly a factor of three in the past decade. There has been some small growth in the DOE RD&T programs, but it has not come close to keeping pace with either DOD RDT&E or DOE procurement.

I believe that the DOE RD&T activity is not supported as fully as it needs to be to do all the things we need done, including SDI research of the kind that I have described and research on our normal deterrent forces out into the future. In 1979, a milestone in our joint DOD-DOE planning for this program was a rather extensive study that you may have heard called the Starbird Study. Retired Lieutenant General Starbird, who had been in the nuclear weapons program for three decades at the time, chaired this study; and it forced us to start looking further into the future than we had in the joint planning before.

In the area of research and development, he suggested that the R&D manpower should grow from a level of about 7,400 heads in 1980, which was down from about 10,000 the decade before, up to a level of about 8,500, a growth of about 1000 or 1100 heads, or perhaps 15 percent.

Progress in achieving this objective is continuing, reaching 8,150 in 1985, and planned to reach 8,400 in 1986. However, the Starbird Study did not anticipate the inception of a new program, the President's Strategic Defense Initiative (SDI), in which the DOE has a significant role which constitutes an unforeseen expansion of its ongoing responsibilities. In order for DOE to support this essential activity, the level of effort in the core program has actually decreased in the last few years; this loss directly impacts the DOD by reducing development activities for our future weapon systems. Therefore, I feel that the Starbird Study manpower goal of 8,500, to be consistent with the initiation of SDI, should be increased substantially, perhaps to around 9,500 in order to maintain proper attention to the core program.

The FY 1986 Atomic Energy Defense Activities Budget Request has received close scrutiny within the Administration. Mandated increases in the areas of compliance in the environmental legislation, and substantially increased safeguards and security efforts, have put substantial new burdens on the program, while not directly related to getting product out the door; approximately 14% of the budget request is devoted to these efforts. As a result, a number of necessary programs have been reduced to undesirably low levels within this submission; examples are ICF and SIS line item requests.

Rather than consider further reductions in the extremely constrained FY 1986 submission, I urge you to begin to anticipate the need for substantial increases in the following years to support adequate RD&T manpower levels, RD&T revitalization, SDI, SIS production, and, as mentioned in my prepared statement, new uranium enrichment.

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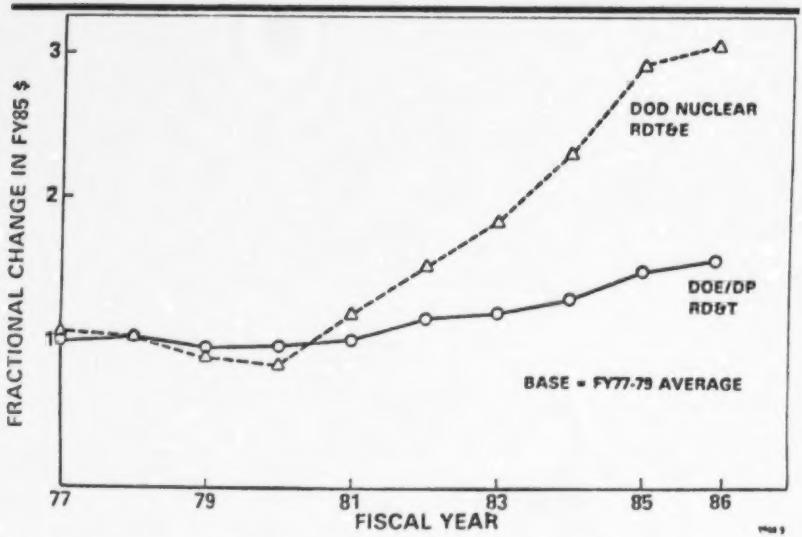
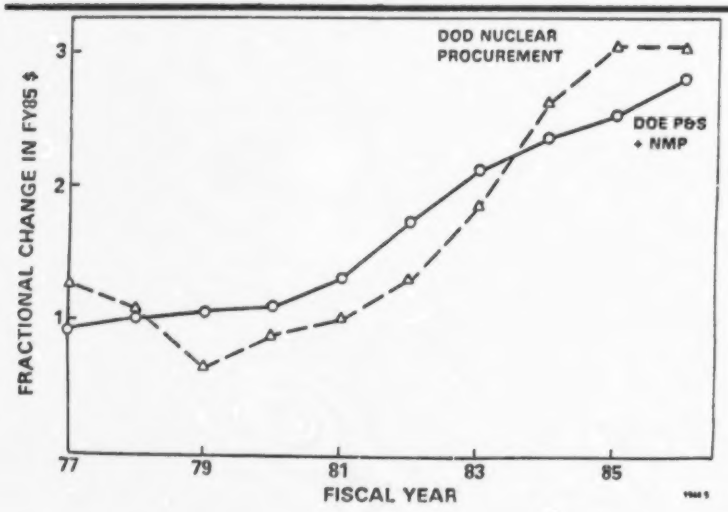
RELATIVE GROWTH OF DOD AND DOE NUCLEAR RD&T



RELATIVE GROWTH OF DOD AND DOE NUCLEAR PROCUREMENT



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QUESTIONS SUBMITTED BY SENATOR GARY HART

X-RAY LASER

(For Dr. Wagner and Laboratory Director)

Senator HART. [Deleted.]
Dr. WAGNER. [Deleted.]
Dr. BATZEL. [Deleted.]
Dr. DACEY. [Deleted.]

THRESHOLD TEST BAN

Senator HART. Please clarify the ongoing dispute among [deleted] scientists over how well the U.S. can monitor Soviet underground tests. How many times have the Soviets exceeded the 150 kt limit?

Dr. WAGNER. Our primary method for monitoring Soviet compliance to the Threshold Test Ban Treaty (TTBT) has been to measure the energy which an underground nuclear explosion couples into the earth as seismic or pressure waves. The fact that the method is very imprecise is universally accepted. Even when we use the method to look at our own tests where we know the geology quite accurately, the answers we get can be higher or lower than the actual test yield [deleted]. Where we do not have precise information on the site geology, the propagation paths or testing practices, the uncertainties can be much larger. Such is the case with the Soviet nuclear test sites at Semipalatinsk and Novaya Zemlya.

The dispute to which I believe you refer arises when we attempt to quantify these unknown aspects of the Soviet test sites. If these attempts were based on more direct measurements, there would be no dispute, although we would still be confronted with the innate limitations of the teleseismic method. Unfortunately, the scientific community which has been called upon to assess these aspects only has inferential information on which to base their conclusions. Where these assessments have been made in the past, they have generally had the effect of lowering our estimation of Soviet yields. After they have been formally instituted in our calculational methodology, the Soviets, as they did in 1977, have indexed the yields of their tests upward possibly to take full advantage of the change. However, whether or not the instituted change, or bias, relates in any way to the observed increase in Soviet seismic magnitudes is unknown to us. But we note its occurrence to register our concern.

With this degree of uncertainty and the imprecision inherent in the teleseismic method, it would be difficult to say that a specific Soviet test exceeded 150 kt. Consideration of the totality of the incident led the President to conclude in his report to Congress on Soviet non-compliance with Arms Control Agreements that the Soviet Union has likely violated the 150 kt threshold.

It is precisely because of the uncertainties which everyone agrees to be inherent in the teleseismic method and the further conflicting evidence presented in his report to Congress that the President concluded that more direct verification [deleted] methods, are needed to monitor Soviet compliance to the 150 kt threshold.

Dr. KERR. The Los Alamos position was summarized in our response to Senator Bingaman's first question. Rather than describe the present situation as a "dis-

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pute," we would prefer to recognize differences in technical evaluations of a common, but incomplete, data set. The question deserves peer review by all those technically competent to do so, and because of differences in assumptions and/or analysis procedures, conclusions may differ—a healthy situation, we believe, in dealing with questions of this apparent import.

A quantification of Soviet nuclear test yields, using only teleseismic monitoring techniques, is fraught with uncertainties, systematic errors, and random errors. Observations can be explained by several models. Nonseismic observations could to some appear equally ambiguous and deserve comprehensive evaluation by the total verification community as well. At present, we believe a decision regarding compliance is equivocal; we therefore can be at ease with the DOE's official evaluation that "While uncertainty remains, DOE believes that recent evidence reinforces the conclusion of the President's 1984 report of likely violation."

If enforcement of compliance is required, the best technology with the smallest inherent errors must be applied to the problem. To this end, we concur with the President's decision to seek more accurate measurements [deleted].

Dr. BATZEL. The answer to Senator Bingaman's first question gives Livermore's assessment with respect to Soviet compliance with the TTBT.

The issue of compliance with the 150 kt yield limit using seismic data hinges on two issues: (1) what is the correct relationship between seismic magnitude and yield for the Soviet test sites, and (2) how does one deal with the variation in the seismic coupling, propagation, and receiving processes that introduce random errors in the seismic magnitude measurements. The differences of opinion [deleted] centered on these two issues.

With regard to the first issue, a magnitude-yield relationship has been developed for explosions at the Nevada Test Site. However, virtually all seismic studies have shown that, because of geological differences, the relationship is different for the Soviet test sites by an amount known as the "bias". [Deleted.]

[Deleted.]

The random variations in the seismic data can make any explosion appear to be either smaller or larger than its actual yield, even if the bias is known. For example, with a series of 150 kt explosions, half of them will appear to an observer to be greater than 150 kt and half smaller. Thus, the issue of compliance must be dealt with in a statistical framework. For this reason, about a year ago DARPA established a Statistical Working Group (SWG) to review this issue. As the SWG has stated, the best that can be done is to calculate the probability that any given explosion or group of explosions is not in compliance with the 150 kt limit.

[Deleted.]

Dr. DACEY. There were three questions posed by Senator Hart which concerned verification. Sandia has no comment on the dispute posed in this particular question.

X-RAY LASER

Senator HART. Dr. Wagner, wouldn't Soviet development of nuclear-driven x-ray lasers in an ASAT mode imperil the survivability of all U.S. space-based assets? Doesn't this threaten the viability of the strategic defense initiative in the absence of control on these systems?

Dr. WAGNER. One reason for our research on x-ray lasers is to determine their feasibility and potential capability, if developed by the Soviets, against proposed SDI

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assets. Our research will directly be used in our SDI survivability program to determine if countermeasures can be developed. Research on techniques to harden, shield, or otherwise protect our future space-based assets is a critical part of the SDI activity.

[Deleted.]

QUESTION SUBMITTED BY SENATOR HART FOR THE LABORATORY DIRECTORS

Senator HART. Dr. Kerr, Dr. Batzel and Dr. Dacey, what areas of verification technology research are currently underfunded?

Dr. KERR. Recent, unanticipated events in the international arms control arena emphasize the need for additional resources in verification technology development. Indeed, the Shultz-Gromyko talks in January not only reopened the stalled talks on strategic and intermediate nuclear forces, but also opened the door for discussions related to outer space. Meanwhile, the initiative tabled by Bush for an accord on chemical and biological weapons remains in Geneva. Also, the President, in an address to the UN General Assembly, proposed to the Soviets an early exchange of experts to measure directly yields of underground nuclear tests.

Although verification of existing treaties and [deleted] have been responsibly considered in the normal FY 1986 budget cycle by DOE/OISA, the budget could not have anticipated the recent and rapid developments in the international arms control arena. Now, in addition to our existing responsibilities, we must prepare to support additional arms control initiatives related to TTBT, START, INF, directed energy, outer space, and chemical/biological weapons.

We have examined the technical essentials to meet not only our continuing commitments but also to respond to new requirements made urgent by the accelerating pace in arms control initiatives. If new technologies need to be provided, or the limits of our ability to monitor new agreements need to be defined in support of the negotiating process, Los Alamos and the other national laboratories might find it difficult to respond in a more timely and relevant manner given earlier budget assumptions. On this basis, we have suggested a nominal increment to the FY 86 budget as presented to the Congress. The increment, we believe, will allow us to focus elements of the base technology that resides at Los Alamos on the arms control issues of this day, draw from them, and expand research and development efforts in support of agreements relating to START and INF arms reduction, directed energy and space activities, and chemical and biological weapon development.

Dr. BATZEL. Areas of treaty verification research that are currently underfunded would include:

a. The use of high frequency signals for seismic verification, including cavity decoupling, studies of path and site effect, and site selection.

b. The use of regional arrays and high frequencies as functional elements of in-country seismic networks and signal processing systems.

c. The use of nuclear weapons tests at NTS as opportunities to gain data for various verification issues such as seismic verification of the TTBT, enhanced verification of the TTBT [deleted] yield measurements, and CTBT on site inspection technologies.

d. The development of in-country verification concepts, methods and technologies for INF, START, and CW Treaties.

e. Interaction of other National Technical Means with seismic monitoring.

Dr. DACEY. If current trends continue regarding the recognition of the need for cooperative verification techniques, including technical and human on-site inspection for potential nuclear arms limitations and chemical weapon bans, then the relevant technologies need additional support. Many of the basic technologies have been developed in the DOE laboratories for nuclear test ban and non proliferation treaty monitoring, including sensors, data handling, data authentication, and equipment tamper protection, and work is needed to further develop the technologies for the new applications.

QUESTIONS SUBMITTED BY SENATOR CARL LEVIN

NOVA/ICF

Senator LEVIN. Dr. Batzel, what are the milestones of Nova? Will Nova be totally devoted to the ICF program? Will Nova be used for any x-ray experiments? What is the total cost of Nova? If Nova is used for experiments other than for the ICF program, how will the cost be spread?

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Dr. BATZEL. The completion milestone for the Nova facility was accomplished December 20, 1984, on schedule and within budget.

We are currently installing diagnostics for the first set of experiments on the Nova target chamber. We expect to conduct the first experiments in mid-May. These experiments will address weapon physics issues. The second set of experiments will be directed toward extending our understanding of the laboratory x-ray laser which was first demonstrated on our Novette laser system last July.

Nova is to be used for ICF Program experiments and for weapons program experiments. Operating costs of the laser system itself are apportioned accordingly. Notably, the majority of experiments which are proposed by both programs are of joint interest.

The total construction cost of the Nova facility was $176 million, to which approximately $25 million should be added as the cost of target diagnostics used with the facility on any given experimental campaign. Thus, as a fully operable experimental facility, the cost is approximately $200 million. It will cost $50 million per year to effectively utilize the Nova facility, and another $20 million per year to operate a balanced ICF Program including [deleted] some laser development.

Senator LEVIN. Is the ICF Program of major importance to your Laboratory and to your nuclear weapons program?

Dr. BATZEL. ICF research is of major importance to the laboratory and to the national nuclear weapons program. The major contribution of ICF to date has been in computational physics models developed for ICF, but it is also of great utility in nuclear design. With Nova operational, we will have a major experimental tool to explore nuclear weapons physics questions of materials opacity [deleted] and instabilities. Such laboratory experiments can complement underground test data and, in some cases, may provide data that has been heretofore unavailable.

The ICF program is of major importance to our laboratory for several reasons. First, it is the only other large program at the laboratory which is directly supportive of and broadens the weapons program. This is because it addresses similar high energy density physics, helps extend our weapons design codes, substantially augments the development of diagnostic techniques and instrumentation, and [deleted] extends the regime of our underground nuclear tests. Second, half of the ICF program resources for laboratory experiments are currently devoted to weapons physics experiments relevant to our conventional and third generation nuclear weapons development programs. Third, the ICF program has been a major pipeline for bringing in new bright young scientists into the laboratory. The ICF program has received much publicity, and that has materially aided the recruiting of new talent. Thus, I believe that it is very important to preserve the ICF program as a separate program rather than to fold it into weapons research and development. As a separate program, its overall contribution to the missions of the laboratory will be maximized.

Senator LEVIN. What is your view of the technical success of your ICF program and of its present utility?

Dr. BATZEL. The ICF program at LLNL has been technically successful [deleted]. The utilization of the ICF technology for weapons physics studies has been made possible by the control and virtual elimination of electron preheat achieved during the last three years by the use of very short wavelength light (0.26–0.53μ) for target irradiation. Prior ICF studies worldwide at wavelengths of 1.0μ to 10.6μ were plagued by electron preheat which made most weapons physics experiments very difficult to interpret.

However, the wavelength conversion of the Novette laser at LLNL to 0.26μ and 0.53μ demonstrated a virtual elimination of electron preheat, opening the way for a wide variety of weapons physics studies. Thus, demonstration of 65 megabar shock waves in metals was rapidly achieved, making possible equation-of-state studies of materials used in nuclear weapons in the laboratory. Also achieved was the first demonstration of stimulated emission (laser action) in the soft x-ray region of the spectrum. [Deleted.] As I have previously commented, the ICF program is of great utility to the weapons program in many ways. I also believe that in the long term ICF may well make a substantial contribution to achieving the production of fusion energy. The goal of energy production by fusion is an important one, and thus at least two different technical approaches (ICF and Magnetic Fusion Energy) are warranted until the goal is reached.

Senator LEVIN. Do you think that the FY 1985 relative levels of funding between weapons RD&T and ICF at LLNL were approximately correct?

Dr. BATZEL. Yes. The funding for the LLNL weapons and ICF programs supported balanced efforts which are making major scientific and technical contributions.

Senator LEVIN. If the current ICF funding requests of $23 million and the weapons R&D funding of $220.7 million are not augmented, how many people will you

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have to let go from the Laboratory? Can this be done without a reduction in force? Is such a reduction consistent with your view of national and defense priorities?

Dr. BATZEL. About 450 people would have to be let go from the laboratory if ICF funding and weapons research and development funding are not augmented. About 250 of that total would be direct staff. This reduction comes about because the design laboratories must reallocate research and development funds internally to make up the ICF funding shortfall caused by the $99 million (59 percent) reduction to that program. If accompanied with cuts in other programs, particularly magnetic fusion, the total reduction could be 1,000 people exceeding annual attrition through normal staff turnover. The contributions which these programs make to the national and defense priorities are well documented and warrant continued support at FY 1985 levels or above.

INERTIAL CONFINEMENT FUSION

Senator LEVIN. Mr. Hoover, what progress has been made in developing new laser technologies in the ICF program? How much money is spent on new laser technology? What is each participant of the ICF program doing in this area and how much is each participant spending? Can any of the new laser technologies be applied to Strategic Defense Initiative?

Mr. HOOVER. Under Congressional direction, we deemphasized advanced laser work in FY 1981. Subsequently, I authorized Los Alamos and Livermore to pursue discretionary efforts to identify low-cost, single-shot drivers for weapons research. Livermore is spending about $4 million on this effort in FY 1985. Los Alamos has developed a krypton fluoride laser module with both ICF and DOD funding. At the requested budget level, we could not pursue the KrF laser for ICF. At the concept and the system definition stages, which is about where we are respectively with advanced solid state (Livermore) and KrF (Los Alamos), almost any new lasers have the potential of contributing to the Strategic Defense Initiative. The non-nuclear concepts area of Strategic Defense Initiative is being pursued by the DOD, in part by direct DOD funding of efforts in the national laboratories.

Senator LEVIN. Considering Los Alamos is confined to a driver technology which has no application to the ICF program, what is the justification for their continuing in the ICF program? Is there any use for the Los Alamos laser, ANTARES, in any other program?

Mr. HOOVER. The role of Los Alamos in inertial fusion has never been confined to a single driver technology. As one of the two weapons design laboratories, Los Alamos has a variety of ICF and purely weapons-oriented approaches to fusion physics. Antares has enabled Los Alamos to determine whether the long wavelength carbon dioxide laser is an adequate driver for the long-term fusion applications. Antares has a number of wavelength-independent uses in weapons research. Furthermore, the Centurion activity at Los Alamos is central to both ICF research and weapons physics studies. In addition, Los Alamos has been pursuing system definition and evaluation of the krypton fluoride short wavelength gas laser. We have not yet made a decision on proceeding with prototype development of a KrF laser for ICF and weapons physics experiments, and will not do so until after the ICF review by the National Academy of Sciences is completed.

Senator LEVIN. DOE has changed the status of ICF from a separate program office under a civilian Assistant Secretary for Defense Programs to just another program under the Office of Military Application. Since that change, the previously strong DOE support for ICF has completely deteriorated, leaving OMB in charge of the program direction. In addition, this excellent program has ceased to exist as a line in the budget, and the remaining funds have been distributed with apparently little direction. This comes at a time when the ICF program is making rapid progress and is technically very successful. What are you doing to address these management problems in the ICF program?

Mr. HOOVER. Mr. Chairman, the Office of Inertial Fusion and the Office of Military Application are separately and discretely managed, although both do report to the Deputy Assistant Secretary for Military Application. Combining the inertial fusion effort within the weapons research and development budget gives us greater flexibility for the prioritization of those activities which have the greatest benefit to the weapons program. We believe that the success of the inertial fusion program to date and the implications of a successful program over the long term justify the maximum support possible within the constraints of the budget and are consistent with national priorities. We are committed to achieving that balance.

Senator LEVIN. What was the technical or programmatic justification for OMB to initially cut out all ICF funding?

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Did you reclama ICF funding with the same enthusiasm that you did in the rest of the weapons program?

If you view ICF as just another piece of weapons program, why have you apportioned a 55 percent cut in ICF and only a 7 percent cut in the program overall?

Mr. HOOVER. Faced with very severe budget constraints, we felt it is necessary to make tough priority choices regarding the level of funding assigned to Inertial Confinement Fusion. The Inertial Confinement Fusion program is a weapons research program that will continue to make significant contributions to the weapons program technology base which supports such activities as Strategic Defense Initiative. We believe that Inertial Confinement Fusion should "compete" in the overall nuclear weapons research and development program rather than retaining a separate status. In this mode, the exact amount devoted to any specific research and development activity, such as Inertial Confinement Fusion, will be determined by laboratory directors after authorizations and appropriations.

Senator LEVIN. Mr. Hoover, did you support General Withers' decision to distribute the remaining $70 million in ICF without regard to technical accomplishment and without regard to impacts at the laboratories or supporting contractors?

If the $70 million is not going to be spent to achieve specific technical milestones and goals, why should you be allowed to spend it at all?

Mr. HOOVER. In general, we feel that the Department must continue to foster a balance in the overall defense-related research and development effort at the laboratories, leaving it to the laboratory directors to assess their own priorities and determine the specific funding levels which best support departmental priorities within the constraints of their individual budgets. However, we do agree that there may be times to strengthen technical success. We do plan to review this decision at an appropriate time.

Senator LEVIN. Mr. Hoover, you are the first Assistant Secretary that has not strongly supported the ICF program. Would you explain why this program is apparently not worthy of your support?

Mr. HOOVER. I do support the ICF program; it is a matter of overall priority. The Inertial Fusion Program has made many noteworthy contributions to the weapons research, development, and testing effort and promises to contribute to an inexhaustible energy source for the next century. As part of the overall research and development technology base at the laboratories, it will continue to receive the strongest support allowable within the limits of budget and consistent with departmental priorities.

Senator LEVIN. The Nova facility was just completed at a cost of $176 million. Why have you split the ICF funding such that this facility must be closed? Did your technical staff in the Office of Inertial Fusion recommend this funding split? What split did they recommend?

Mr. HOOVER. When it was decided to place all ICF activities within the weapons research, development, and testing effort, various technical and programmatic options were considered to best support both weapons research and inertial fusion. We feel that the determination to leave apportionment of laboratory funds to the discretions of individual laboratory directors will allow Nova to be funded so that it can be operated effectively for both weapons and inertial fusion experiments.

Senator LEVIN. Can you explain the rationale behind cutting LLNL by 67 percent and KMS Fusion by 60 percent, when the University of Rochester is not cut at all and Sandia is cut by only 25 percent?

What are the technical milestones that go with such an arbitrary allocation of funds, or are you just spending the money to spend it?

If you expect the laboratory directors to allocate the ICF money, why did you not proportionately allocate the $70 million to all participants?

Mr. HOOVER. A $70 million budget places severe constraints on available options. Our rationale for establishing the requested budget included a modification of the balanced laboratory level of effort concept, which has been used to manage the weapons research and development program for many years, as well as factors such as laboratory and contractor impact, facility capability, and technical expectations. Under this approach, Sandia will receive approximately one-third less. The University of Rochester, however, will receive a less severe cut. This is appropriate because they are not able to draw upon other bases of support such as weapons research and development.

Again faced with new budget constraints and program priorities, we anticipate there will be some changes to previous program planning. Subsequent to completion of the Congressionally mandated review of the Inertial Fusion Program, we will again reassess and realign our milestones as appropriate.

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Senator LEVIN. You have said much about laboratory balance. Don't you think laboratory technical excellence is more important? How will excellence fluorish under your stewardship if laboratory balance is always rewarded over laboratory accomplishment?

Mr. HOOVER. We must do both. In general, laboratory balance is the rule, with laboratory directors assessing technical priorities. However, there are cases where we may wish to strengthen technical success.

Senator LEVIN. Mr. Hoover, Congress directed DOE to conduct sufficient research in the ICF program in FY 1985–1987 to permit Congress to make a fully informed major program decision in FY 1987 about the potential and future direction of the entire United States ICF effort. This decision was to be based on information expected to be developed through many experiments and other research and development funded at a much higher level than the current FY 1986 budget request for ICF.

Under the drastically reduced funding level requested for FY 1986, specifically what experiments and research and development projects will not be done that had been included in previous DOE plans, programs, and budget projections as necessary to support the FY 1987 ICF decision?

What particular information, thus, will be unavailable to Congress and to the Executive Branch to support a fully informed decision in FY 1987?

Mr. HOOVER. No new projects were included in the DOE FY 1983–1987 ICF program plan. Approximately level funding has been made available through FY 1985. Thus, the only change from the plan I approved three years ago is the level of funding in FY 1986 for experiments, which will be stretched out at the requested funding level. An FY 1987 program decision is not now likely, but there is now under way the Congressionally authorized outside technical review of the program from which we expect to have preliminary conclusions this summer and a final report next year, in time for the FY 1987 Congressional budget cycle.

Senator LEVIN. Isn't it true that a large number of classified experiments must be performed to explore the physics issues confronting inertial fusion in order to optimize the changes of NOVA accomplishing its mission?

Mr. HOOVER. With the constrained ICF funding of recent years, we undoubtedly have not developed the fullest possible data base for starting Nova experiments. However, Nova is now about to start the scaling experiments for which this high energy laser system was developed. After the first series of ICF experiments on Nova is completed later this year, we will be in a better position to determine what supporting experiments may be most useful. For this reason, we wish to remain as flexible as possible on commitments to future experiments and experimental capabilities.

Senator LEVIN. Isn't it true that KMS Fusion is the only support laboratory with the history and capability to perform fully integrated classified target experiments as part of the glass laser program?

Mr. HOOVER. Yes, that describes well some of the characteristics of a Nova support capability. However, the energy level of the Chroma laser at KMS Fusion is now about 600 to 800 joules, about two orders of magnitude below the energy of Nova at shorter wavelengths. The University of Rochester system, Omega, has a comparable energy level to Chroma's. In addition, we have a target irradiation capability at the Naval Research Laboratory. However, the scaling of target interaction phenomena at higher energies can be observed and measured only in the Nova experiments.

Senator LEVIN. Isn't it true that KMS Fusion has performed thousands of successful relevant target experiments and generated a large classified physics data base in support of the glass laser program?

Mr. HOOVER. Yes. We are entirely satisfied with the close working relationships within the glass laser program coordinated by Livermore as the lead laboratory. I would like also to note for the record that KMS Fusion's target fabrication capability has supported all the program participants and that KMS Fusion is now developing a cryogenic target support system for experiments on the University of Rochester's Omega laser.

Senator LEVIN. Isn't it true that Chroma, the glass laser at KMS Fusion, could be modified to increase its power 3.5 times in order to perform experiments which are relevant to the success of Nova?

Mr. HOOVER. Frankly, I do not know. After the first series of scaling experiments on Nova has been completed later this year, we expect to have a better idea of what supporting experiments may be useful. Our current view is that the critical needs for Nova ICF experiments will be in the target fabrication area. This is a longstanding strength at KMS Fusion upon which we hope to draw, resources permitting, for Nova experimental support.

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Senator LEVIN. Isn't it true that, as modified, Chroma would perform at a rate of 4 to 5 times the target shot performance of Nova at less than 3 percent of the cost per experiment?

Mr. HOOVER. No. For integrated target experiments, setting up activities dominate both time and cost. The shot rate of all ICF systems is more than adequate at the present time since the set-up time for an integrated experiment would be of the order of a day, even on Chroma. Further, it may not be meaningful to compare the cost and rate of Chroma with the target shot performance of Nova, which is a hundred times larger. Three percent of the average cost of a Nova experiment would be difficult to calculate. Livermore Director Roger Batzel has testified that the cost of maintaining Nova as an experimental facility during FY 1986 would be $50 million. This level would support both ICF and weapons physics experiments that would vary widely in complexity and number, and therefore also set-up time and cost. We will be strongly influenced by the technical judgement of the lead laboratory as to the priority for supporting experiments versus scaling experiments on Nova itself.

QUESTIONS SUBMITTED BY SENATOR JEFF BINGAMAN

URANIUM QUESTIONS

Senator BINGAMAN. Mr. Hoover, our country has made a considerable effort to develop a domestic uranium industry capable of serving all our needs in order to avoid dependence upon foreign sources. The Atomic Energy Act requires DOE to "assure the maintenance of a viable domestic uranium industry" in the conduct of its enrichment activities. Unfortunately, our domestic uranium industry has virtually shut down. The industry faces close to 90 percent unemployment. In the meantime, imports for Canada and Africa are increasing rapidly. Additionally, officials in DOE's enrichment program have taken a number of actions which are reducing demand for uranium. One of these measures involves the planned initiation of new "split-tails" operations. It is my understanding that DOE plans to use in excess of 100,000,000 pounds of uranium from the defense stockpile in the next 5 to 10 years as "overfeed" in its enrichment program. The agency will value this 100,000,000 pounds of defense uranium at $9.00 a pound and will distribute it to foreign and domestic utility customers in lieu of enrichment. $9.00 per pound is a fraction of the spot market price which is in the $15–$18 range. How did the agency arrive at the $9.00 per pound price?

Mr. HOOVER. The Government currently has on hand a substantial inventory of about 110 million pounds of natural uranium, purchased in the past to support the uranium mining industry. The Government currently utilizes this inventory of natural uranium to supply feed for military requirements. This material can also be used to reduce the cost of operation of the gaseous diffusion plants by lowering the Government's purchases of electricity. This utilization of inventory is called "split tails" operation. The Government's policy is not to offer any of its uranium into the market place for direct sale in a manner that would compete with the uranium mining industry. Split tails operation does not reduce the amount of uranium feed which our utility customers are required to supply. Rather, it depletes the Government inventory of natural uranium and allows the uranium enrichment enterprise to be more price competitive. To determine the value of the natural uranium used in these Government-related operations, we use the historical acquisition cost that the Government paid to the uranium mining industry when the uranium was purchased.

Senator BINGAMAN. How much uranium (in pounds of natural uranium equivalent) is held by the U.S. Government in the following categories: (a) outmoded weapons, (b) depleted tails, (c) natural uranium, (d) enriched uranium, and (e) other forms (please specify)? For each category, what percentage is foreign origin?

Mr. HOOVER. The uranium that is returned from existing weapons is recycled for use in current weapons systems. Therefore, there are no outmoded weapons systems held by the Department. I will provide additional information for the record.

[The information follows:]

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ATOMIC ENERGY DEFENSE ACTIVITIES

INVENTORIES OF URANIUM WITHIN THE U.S. GOVERNMENT

[Pounds of natural uranium equivalent]

	Inventory	Percent foreign origin
Depleted uranium [1]		0
Natural uranium	[Deleted]	1.74
Enriched uranium [1]		0
Total uranium-235		

[1] Evaluated on the basis of a tails assay of 0.2 percent ^{235}U.

Senator BINGAMAN. How much natural uranium will DOE require for defense purposes for each year through the year 2000 under the President's defense program? Please give probable maximum and probable minimum uranium requirements.

Mr. HOOVER. Natural uranium requirements for defense purposes are very uncertain because they are related to future national policy decisions. For planning purposes, the Department is currently considering two alternative defense requirement cases. The Government's natural uranium requirements associated with these cases are shown in the following table:

GOVERNMENT URANIUM REQUIREMENTS [1]

[In millions of pounds U_3O_8]

	Low case	High case
Fiscal year:		
1986	5.3	
1987		
1988		
1989		
1990		
1991		
1992		
1993	[Deleted]	[Deleted]
1994		
1995		
1996		
1997		
1998		
1999		
2000		

[1] Based on expected DOE transaction tails assays. All requirements can be met from existing DOE uranium inventories.

Senator BINGAMAN. How much of this uranium does DOE intend to buy on the market for each year through the year 2000? When does DOE expect to begin contracting from these requirements and how much does DOE expect to pay?

Mr. HOOVER. The DOE has no plans to purchase this material on the market through the year 2000.

Senator BINGAMAN. What provisions are made or measures taken by the United Kingdom and France to assure their own uranium supplies (e.g., do they maintain stockpiles and what does France do to maintain its own domestic uranium industry)?

Mr. HOOVER. The United Kingdom and France maintain uranium stockpiles to meet 1 to 4 year forward requirements, but detailed data are not available.

The United Kingdom nuclear power uranium requirements are 2,000 to 3,000 tons U_3O_8 annually, and they will remain at approximately the same level over the next several years. Needs are to be partially filled from delivery contracts with Rio Algom in Canada. In the past, there were contracts for production in Australia and Namibia. United Kingdom based companies with uranium resources include Rio Tinto (Rossing in Namibia) and British Petroleum (Roxby Down in Australia).

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France needs approximately 9,000 tons U_3O_8 for her nuclear reactors in 1985, increasing to about 11,000 tons U_3O_8 by the 1990's. Domestic uranium production is about 4,200 tons U_3O_8. Remaining demand can be more than filled from French interests in several uranium operations including:

Canada—Cluff Lake.
Namibia—Roessing.
Gabon—Oklo.
Niger—Arlit and Akouta.

France has an 80 percent interest in Pathfinder Mines in the United States, but does not currently purchase any of the production.

In order to maintain domestic production, France has an aggressive exploration program which continues to be very successful.

Senator BINGAMAN. Does DOE continue to support the maintenance of a secure, independent, and viable uranium enrichment industry and a uranium mining and mill industry in the U.S. capable of meeting U.S. requirements? If not, why?

Mr. HOOVER. The Department believes it is important to the long-term energy national security interest of the United States to have a domestic uranium production capability. However, the significant contraction of the U.S. uranium mining and milling industry has resulted primarily from the continued deferral and cancellation of nuclear power plants. This has resulted in over capacity and large inventories in the hands of utilities. The problems of the industry are also exacerbated by foreign competition with lower production costs due to higher grade ores and lower labor costs, coupled with very favorable currency exchange rates due to the current strength of the U.S. dollar.

In December 1984, Secretary Hodel found that the domestic uranium mining and milling industry was viable for 1983. In the future, if the Secretary of Energy finds that the industry is not viable, the Department will make recommendations to correct the situation.

A key feature of the recently issued utilities services enrichment contracts is the availability of a Variable Tails Assay Option for the purpose of obtaining enriched uranium. The Variable Tails Assay Option permits all utility services contract holders to select any tails assay they desire, although tails assays below 0.20 or above 0.30 percent U-235 will be provided by the Department on a best efforts basis. It appears likely that our customers will select, on the average, a tails assay on the order of 0.25 percent U^{235} or greater over the next several years. This will increase uranium sales by more than 10 percent over previous enrichment contract terms.

INSERTABLE NUCLEAR COMPONENTS

Senator BINGAMAN. Dr. Wagner, you mention the possibility of using insertable nuclear components for fleet weapons, perhaps in some cases as convertible systems. This would seem to further blur the distinction between conventional and nuclear warheads, and make verification of limits on dual capable systems such as SLCM's even more difficult. What is, in your view, the implication of INC's for arms control?

Dr. WAGNER. Obviously, the use of insertable nuclear components in nuclear dedicated rounds would not blur the distinction between conventional and nuclear rounds in any way. The desirability of future improvements to the survivability and operational flexibility of U.S. theater nuclear weapons makes the incorporation of insertable nuclear component (INC) warheads a militarily attractive option. The improved survivability resulting from INC's would enhance crises stability. Even the use of INC's in convertible warheads would pose no unique problems for constructing theater nuclear arms limitations, since the distinguishability problems for guarding against circumvention of any future treaty result from dual capability generically, and not from convertibility.

SMALL BALLISTIC SUBMARINE

Senator BINGAMAN. Admiral McKee, could you describe any work at present to develop a reactor for the small ballistic missile submarine recommended by the Scocrowft Commission? How soon could such a reactor design be ready so that we could design a small SSBN around it? Is the reactor likely to be the pacing element in the development of such a submarine?

Admiral MCKEE. Requirements for a new smaller ballistic missile submarine have not been established. Existing reactor designs may be suitable for a new ship. However, until ship requirements are established the extent of reactor development or pacing element cannot be determined.

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WASTE ISOLATION PILOT PLANT

Senator BINGAMAN. Mr. Cochran, I commend you for your testimony regarding the Waste Isolation Pilot Plant project in Carlsbad, New Mexico. I appreciate you reemphasizing that WIPP is not being designed for the permanent disposal of high-level waste, nor has the site been characterized for such permanent disposal. You also recognized the importance of working with the State of New Mexico. This certainly has been demonstrated by the recent agreement reached between DOE and the State. I understand there are still a few issues to be resolved and that the agency and State are currently working to clarify these. My questions concern a couple of these remaining issues.

As WIPP is constructed, can we receive assurances that there will be no separate or unique set of standards for evaluating the quality of construction at WIPP, especially with respect to emergency barriers between the waste and the salt walls? Will the standards be inferior to existing NRC and EPA standards for other waste handling facilities?

Mr. COCHRAN. Research and experimental programs at WIPP are addressing the technical problems of "emergency barriers between the waste and the salt walls" under the general context of engineered barriers as defined by EPA in recent draft standards Any engineered barrier would be in addition to the geologic barrier provided by the salt itself.

WIPP standards applicable to the barrier issue will be equal to or better than EPA requirements. WIPP's goal is the same as EPA's and NRC's in assuring a safe environment. In addition, all experimental programs at WIPP are subject to review and coordination with the State of New Mexico. A meeting was held in April with the State of New Mexico, Environmental Evaluation Group, to coordinate issues concerned with the WIPP underground barriers experimental program.

It is not clear at this time that an additional barrier is needed which entirely surrounds the waste packages; however, additional research is underway at WIPP to see if a redundant barrier would provide significant added confidence.

Senator BINGAMAN. What type of quality assurance can be expected for construction materials at WIPP? Will the standards for this project be equivalent to existing NRC standards for other waste handling facilities or will they be less rigid?

Mr. COCHRAN. The quality assurance program for the design and construction of the WIPP facility complies with the Quality Assurance Program Requirements for nuclear facilities. This program addresses the same basic quality assurance program elements required for the commercial waste handling facilities as described in 10CFR Part 60, Subpart G.

The quality requirements for construction materials are derived from the design classification system and incorporated into the design specifications. The design classification system has been reviewed by the State of New Mexico's Environmental Evaluation Group which has provided its general agreement as to its application to the WIPP project.

The WIPP quality assurance program verifies that the procurement of construction materials is in compliance with the design documents. The State of New Mexico's Environmental Evaluation Group has a quality assurance representative at the WIPP site reviewing our total construction program. All of the State's quality assurance reports, thus far, have indicated concurrence with the WIPP's construction quality program.

Senator BINGAMAN. Can we receive a commitment from the agency that information regarding the risks associated with transporting both high-level and transuranic wastes will be provided to the State of New Mexico as soon as possible? As I understand, the State has requested this information be provided quickly in light of the expedited construction schedule at WIPP?

Mr. COCHRAN. The Department is committed to providing to the State of New Mexico, as soon as possible, an assessment of the risks associated with transporting both high-level and transuranic wastes. A preliminary transportation analysis for contact-handled transuranic, CH-TRU, waste was prepared and reviewed by the State and is now being revised to include updated information on radionuclide distributions in the transuranic waste and to address the State's comments. An analysis is being performed which will provide the State with information concerning the transportation of remote-handled transuranic, RH-TRU, waste. A similar analysis will address the transportation of Defense High-Level Waste, DHLW, to WIPP for use in the planned DHLW experimental program. The CH-TRU analysis is nearing completion and will be provided to the State in the near future. The RH-TRU analysis is progressing and will be provided to the State shortly after the submission of

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the CH-TRU analysis. The transportati analysis for DHLW will also be performed and provided to the State as soon practicable.

It should be noted that although there are some construction activities which are ahead of schedule, the agency position on the schedule for receipt of waste at WIPP has not changed and remains scheduled for the fall of 1988.

VERIFICATION OF TEST BAN TREATIES

(For the Laboratory Directors)

Senator BINGAMAN. Could you outline your laboratory's views on Soviet compliance with the unratified Threshold Test Ban Treaty? Would you agree with the conclusion that, given the degree of uncertainty in the relationship between the actual yield of a nuclear explosive and the observed seismic signal, it is hard to make a definitive statement regarding Soviet compliance or lack thereof?

Dr. KERR. Verification of compliance with the Threshold Test Ban Treaty (TTBT) now rests on interpretation of teleseismic signals. The methodology includes both systematic and random errors as well as the repeatedly debated and adjusted seismic "bias" between the Nevada Test Site (NTS) and the Shagan River test site. Los Alamos has chosen not to enter the "bias" discussions but has analyzed the compliance issue statistically, using models believed to be consistent with official positions and actions. We conclude that the issue of Soviet compliance is unresolved and, with the methods for verification that are presently available, it appears to be unresolvable. It is indeed hard to make a definitive statement.

This, briefly, is the problem. The number of large seismic signals from the main Soviet test area has heightened concern about compliance. The interpretation of this signal pattern is unavoidably ambiguous. On the one hand, the larger Soviet tests may all be at or below the 150-kt limit, if we assume a large systematic error in estimating their yields from seismic data. Without this assumption, and using present "official" values in the magnitude/yield relationship, we would conclude that there may be a "high group" of Soviet tests [*deleted*]. On the other hand, the observed signals may equally well reflect an entirely different test pattern: mostly yields in compliance, but a few tests that are much larger than the threshold. This more ominous pattern explains the observations just as well, and it cannot be ruled out even if yet another plausible "bias" adjustment is made which in effect lowers the estimated Soviet yields. No method exists for deciding which pattern is the correct one. That is, neither is statistically "indicated" in preference to the other. This means that at present the U.S. cannot have sufficient confidence in Soviet compliance to exclude occasional Soviet tests that are [*deleted*] than the threshold. Such tests could well serve as proof tests for the weapons now believed to comprise the bulk of the Soviet strategic stockpile.

Dr. BATZEL. Based on our assessment of the relationship between yields and seismic magnitudes for the Soviet test sites and the patterns of Soviet testing, we have concluded that the Soviets appear to be observing a yield limit. Our best estimate of this yield limit is consistent with TTBT compliance.

However, the seismic data are subject to considerable statistical uncertainty, which in turn contributes to [*deleted*] uncertainty in any one yield estimate. [Deleted.] In this regard, it is important to note that, if a comparison is made between the distribution of seismic magnitudes from explosions at the Nevada Test Site with those from the Soviet Test Sites, the two distributions exhibit remarkably similar amounts of statistical scatter.

Dr. DACEY. Sandia agrees that the uncertainty in the relationship between yield and the observed seismic signal makes it impossible to determine whether or not the Soviets are complying with the 150 kiloton threshold. We would add, however, that since the Soviets do know the true yields of their events, and they know the loss of confidence that has occurred because of our uncertainty, they should be willing to work with us to demonstrate that they have not exceeded the 150 kiloton threshold.

Senator BINGAMAN. What is the position of your Laboratory regarding ratification of the Threshold Test Ban Treaty? What is the position of your laboratory regarding improvements in the verification provisions of the Threshold Test Ban Treaty? Is there agreement [deleted] yield measurements would be useful in reducing uncertainty and that the degree of intrusiveness into our own test program would be acceptable?

Dr. KERR. Ratification of the TTBT is a political decision in which adequacy of verification is a salient factor. To assess verification issues, several policy questions must be first answered: what is (a) the yield level at which enforcement of Soviet

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compliance is considered necessary; (b) the frequency with which incorrect technical reports of violations can be tolerated (the acceptable false-alarm rate); and (c) the relative priority attached to avoiding false allegations of noncompliance, on one hand, and to preventing occasional violations of potentially military significance, on the other? A procedure for evaluating the consequences of these policy decisions is now in place; this procedure has already been applied to the present capability and to several feasible candidates for improved verification.

Los Alamos analysis has shown that, of all improvements studied [deleted] yield measurements could significantly reduce the uncertainties regarding Soviet underground test yields. Because this technique depends upon our access to the Soviet test site and their access to ours, we have examined the implications of these measurements on our test program, both in terms of intrusiveness and of possible constraints on that program. While incremental costs would be incurred, and otherwise routine operations would be complicated, we have concluded that the problems are solvable, the solutions are tolerable, and the necessary constraints would not adversely affect our present (five-year) test plan.

Dr. BATZEL. We can meet our current military requirements and do weapon physics research that we deem to be appropriate and necessary within the 150 kt limit. [Deleted.]

[Deleted.] However, the impact upon our current program is not the only consideration. We perceive that significant asymmetrics could develop if the present threshold were removed. Because of ground motion in Las Vegas resulting from nuclear explosions at NTS, we would be limited to explosions of less than 800-900 kg. Prior to the TTBT, the Soviets tested to about 3 Mt at their Novaya Zemlya test site. (Because of the isolated nature of that site, we cannot rule out the possibility of their testing at yields much higher than 3 Mt.) Without a TTBT, the Soviets would thus have a very large advantage in the size of explosions they could conduct. The advantages of increasing test yields from 150 kt to, say 6 Mt, are indeed very significant. Hence, the 150 kt yield limit is a benefit because it prevents a large and technically significant asymmetry in testing capability between the U.S. and the Soviets. While the TTBT preserves the status quo at 150 kt, the preamble to the treaty calls for the discontinuance of all test explosions of nuclear weapons for all time, something which is inconsistent with the context of the Strategic Arms Reduction Talks and arms reduction with modernization. I elaborate on this point in a later answer.

[Deleted] measurements could be useful in reducing the uncertainty in yield determination by providing a means to calibrate the Soviet test sites. However, if it were proposed to make such measurements on all weapons tests, restrictions would have to be placed on the geometry of the experimental configuration of the canisters that contain the nuclear device and the diagnostic equipment. [Deleted.] The exact nature of what the geometric restrictions would have to be are now the subject of active joint research at LLNL and LANL.

The presence of Soviets at NTS would pose operational security problems that could generally be handled. [Deleted.] Inspection of the canisters of these tests to verify that treaty restrictions were being followed could reveal sensitive design information.

Dr. DACEY. Sandia has no position on ratification. We would, of course, like to see improved verification provisions because of the loss of confidence in the treaty regime that has occurred due to the uncertainty in yield measurement. We believe [deleted] yield measurements would be useful in reducing uncertainty.

Senator BINGAMAN. Are there other less intrusive techniques that could be used to reduce uncertainty about the relationship between observed seismic magnitude and the yield of Soviet tests? Would placing a national seismic station at the Soviet test site at Semipalatinsk be useful? Would the station have to operate during Soviet tests to provide useful information, or could we characterize the geology of the Soviet site by looking at signals detected by this station from other worldwide seismic events?

Dr. KERR. Other less-intrusive verification techniques have been, and are being, considered. One, the so-called "calibrated teleseismic," also requires some initial on-site measurements [deleted] but thereafter continues to rely primarily on teleseismic estimates of Soviet yields. Here [deleted] measurements would be conducted on one or more nuclear tests in each geophysically distinct test area. The NTS has a number of such distinct areas and so, presumably, does Shagan River. In addition to being a potentially open-ended approach, the calibrated teleseismic was found in our statistical analysis to result in a marginal verification improvement, at best.

While also requiring confirmation of some yields by [deleted] techniques, the deployment of a number of National Seismic Stations within the Soviet Union and at regional distances from the test sites is another possible technique. Prototypical sta-

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tions have been operated by Sandia Laboratories at regional distances from the NTS for several years. We defer to our Sandia colleagues and their evaluation of possible verification improvements inherent in this approach.

[Deleted.]

Emplacement of a single National Seismic Station at the Soviet test site, inoperative during their tests, would contribute little to our verification capability. At one time, placing a large number of such stations—they were to be spaced in large grid on 3-kilometer centers—was thought to be useful for identification and characterization of the "geophysically distinct" areas within the site. Signals coming into the site from distant sources would be recorded, and outward propagation would be inferred, a "mirroring" process. We understand that the feasibility of this "mirroring" approach to geophysical mapping is now questioned. Regarding the operation of a National Seismic Station during nuclear tests, we would again defer to our Sandia colleagues who operate a local net at the NTS during tests.

Dr. BATZEL. A less intrusive technique [deleted] would be to conduct a few tests at each other's test sites [deleted] yield measurements would be used to calibrate the teleseismic signals. This could result in an improvement in accuracy about halfway between the accuracies of the current teleseismic yield measurements and that obtainable [deleted] measurements were performed for all higher yield weapons tests.

Several seismic stations located at the Soviet test site at Semipalatinsk would be useful to better understand the seismic transmission characteristics of that region of the Soviet Union. Such seismic stations would not necessarily have to operate during Soviet nuclear tests. Using the reciprocal nature of seismic signal propagation, calibration of the test site at Semipalatinsk could be derived by comparing signals (from any seismic source elsewhere in the world) detected at these stations with those detected at existing teleseismic stations. However, the calibration would not be as good as that described in the previous paragraph and important information about the way explosion energy is coupled into the ground would not be available.

Dr. DACEY. We do not believe that placing seismic stations at the Soviet test site would significantly reduce the uncertainty in the yield-seismic magnitude relationship, because the factors causing the uncertainty in the generation and propagation of the seismic signals are not well enough known.

Senator BINGAMAN. How much would our uncertainty in the relationship between observed seismic magnitude and actual yield be reduced by ratifying the TTBT as is and taking advantage of its provisions regarding data exchanges and calibration shots?

Dr. KERR. Consideration of a possible reduction of the uncertainty in the magnitude/yield relationship that would follow the data exchanges and calibration shots specified in the TTBT protocol reduces to an evaluation of: (1) confidence in the accuracy of the data provided by the Soviets; and (2) the technical value of the data themselves. The treaty does not provide for confirmation of the data supplied, especially of the yields reported by each Party for past events in their test areas. Hence, a confidence in Soviet behavior not now uniformly demonstrable would be necessary. While information on the geology of the test areas, i.e., density, seismic velocity, porosity, etc., would be exchanged, we understand that efforts to compute "synthetic" seismograms, using similar data from our test site have been less than totally successful. It is not now obvious how Soviet geophysical data can serve to reduce the teleseismic uncertainties. Even the term "geophysically distinct" is not precisely defined. For these reasons, we conclude that the TTBT data exchange would not be particularly helpful in reducing the present uncertainties.

Dr. BATZEL. While calibration yields provided by the Soviets would not be definitive under the existing TTBT provisions because they could not be corroborated, quantitative data on the geological and geophysical properties of Soviet test sites would be very useful. We already have a significant body of data on the general characteristics of Soviet test sites and it would be very difficult for them to falsify such data in a useful way. The additional detail that would result from this exchange would improve our general understanding of their test sites. However, the improvement would be qualitative rather than quantitative.

On the other hand, the data exchange provided for in the companion PNET protocol would provide a great deal of information about each Soviet PNE explosion. Such a data base would significantly improve our understanding of the geophysical properties of the Soviet Union. For example, pre-knowledge of the locations and times of their past 50 PNE explosions would have provided valuable opportunities to focus various National Technical Means (NTMs) on these events to study such aspects as detection thresholds and seismic signal propagation in the USSR.

The PNET also would establish a Joint Consultative Commission to implement the data exchange and to resolve questions regarding each country's actions with

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regard to the PNET. Such a forum would be a valuable channel for exchange of technical data and compliance questions.

Dr. DACEY. It is difficult to quantify how much the uncertainty would be reduced by the current treaty provisions because the uncertainty depends on how factual the reporting of the yields of the calibration shots is.

Senator BINGAMAN. [Deleted.]

Dr. KERR. [Deleted.]

Dr. BATZEL. [Deleted.]

Dr. DACEY. [Deleted.]

Senator BINGAMAN. Turning to verification of a Comprehensive Test Ban Treaty, what configuration of seismic stations/arrays inside the Soviet Union would in your opinion be needed to verify (1) one kiloton fully decoupled tests and (2) five kiloton fully decoupled tests?

Dr. KERR. Los Alamos has not studied this particular problem extensively. Any estimate of the capability of seismic stations/arrays within the Soviet Union can only be a guess because the U.S. lacks the necessary in-country Soviet explosion data. In addition, the U.S. knows very little about frequency-dependent seismic noise levels and signal propagation within the Soviet Union. One recent study suggested that cavity-decoupling would significantly challenge CTBT verification near 1 kt even with 30 in-country array stations, a much larger number than has been considered negotiable. Shock-mitigating materials may further confuse the issue, permitting even larger yields in a given cavity size. Additional theoretical modeling of seismic decoupling is surely in order as are one or more field experiments to validate the modeling capability.

Dr. BATZEL. It would require more than 30 high-quality in-country arrays or equivalent single stations with high signal-to-noise rations to detect signals from decoupled explosions (or equivalent size earthquakes) with yields of about 1 kt with a 90 percent degree of confidence. With 15 such stations, we could detect decoupled explosion with yields in the range of 3–10 kt 90 percent confidence. Note that detection of an event does not mean identification as to whether the event is an explosion or an earthquake. With either network, the 90 percent confidence level for identification may include events that are 2 to 3 times as large as the detection threshold.

Dr. DACEY. Using the National Seismic Stations or arrays and current knowledge of the generation and propagation of seismic signals up to 10 Hertz in frequency, no practical network in the Soviet Union would detect one kiloton fully-decoupled tests. Five kiloton fully-decoupled tests might be detected by 30 to 40 Regional Seismic Arrays.

Senator BINGAMAN. Without any seismic stations/arrays inside the Soviet Union, as would be the case under the various bilateral testing moratorium proposals which have been put forward in the last year, what would be our capability to detect Soviet testing? At what yield would the Soviets be able to test covertly under such a moratorium with little probability of detection by external seismic monitors or other verification techniques? How many ambiguous seismic events would we likely detect under such a moratorium? What is the possible military significance of Soviet covert testing under such a moratorium?

Dr. KERR. The issue in question involves not only detection of relatively small seismic events but also unequivocal identification of their source. As the seismic magnitude decreases linearly, the number of naturally occurring events during any period increases exponentially. The number of ambiguous events in the Soviet Union could be on the order of a hundred per year at magnitudes corresponding to yields of a few kt in hard rock, or to larger yields if decoupled. Studies underway within the verification community seek to differentiate the seismograms to reveal source, and non-seismic technologies which are source specific are under development and hold promise. But, given credible scenarios which would allow clandestine testing by the Soviets and well-identified weakness in western verification capability at the present, we would tend to agree with the estimate made in the late 1970's [deleted] that testing by the Soviet Union during a moratorium or CTB might be limited to a few tens of kilotons. It is quite possible that much of the Soviet technology base and most of their stockpile can be preserved and maintained indefinitely with tests near this level.

Dr. BATZEL. [Deleted.]

With cavity decoupling, the Soviets could test up to 10 kt with low probability of detection by an external network with the assumed capability. However, it is important to note that it would be an extremely difficult engineering feat to construct cavities large enough to decouple explosions much larger than 10 kt. We cannot rule

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out the possible construction of such cavities, say by solution mining techniques, but it could be difficult for them to hide the construction activity.

[Deleted.]

Dr. DACEY. This question is best addressed by AFTAC, who is responsible for the U.S. capability for monitoring nuclear tests in the USSR.

Senator BINGAMAN. Recently, there have been reports of breakthroughs on seismic detection of nuclear explosions. In particular, high frequency seismometers are said to have reduced the difficulty of detecting decoupled explosions in salt cavities. What is your view of the significance of this new information? To what extent will it reduce the number of seismic stations/arrays needed to detect one kiloton fully-decoupled explosions?

Dr. KERR. High-frequency seismic stations may hold some promise for increasing sensitivity to decoupled tests. For a number of reasons, research in this area has not been pursued aggressively in the past. There is not now a synoptic data base, and the topic has not been subjected to the intensive peer review so typical of verification concepts. It, therefore, is premature to base policy decisions on this concept or to speculate on the number of internal seismic stations necessary to exploit the technology. Because of continuing and valid concerns about decoupling, the high-frequency approach is now the subject of numerous theoretical and experimental investigations, including those at Los Alamos. A more definitive evaluation of this subject should be possible in the coming months.

Dr. BATZEL. There has been no demonstrated breakthrough as yet in seismic detection or identification of nuclear explosions using high-frequency seismometers. We and others have pointed out the new observations of high-frequency signals and low-noise sites which show some promise for seismic monitoring and which are the subject of ongoing research. However, the value, limitation, and generality of these observations have not yet been demonstrated.

The key elements are: (1) the possible reduction in the cavity decoupling ratio at high frequencies (10–40 Hertz); (2) whether the high signal-to-noise ratio observed at those frequencies at one or two stations can be duplicated for an in-country network; and (3) the theoretical differences in high-frequency spectra between earthquakes and explosions that may help with the identification problem. Even with these improvements in signal-to-noise resulting from the postulated developments, their use would become possible only through the use of many (25 or more) internal stations throughout the Soviet Union. Therefore, the use of high-frequency seismic stations and arrays may provide improved detection and identification capability, but the number and the capability of the stations needed is significantly greater than those discussed in the 1978–1980 CTBT negotiations. Much more research is needed before a more definitive statement can be made.

Dr. DACEY. Recent studies, based on limited and incomplete data, suggest that an effective solution to the problem of the detection and identification of low yield and decoupled underground nuclear explosions is available through the use of high-frequency seismic data ranging up to 30 to 40 Hertz. These studies conclude that a network of 40 high-frequency stations, 25 within the Soviet Union and 15 outside, would provide a very effective verification capability at seismic magnitudes equivalent to one kiloton fully decoupled underground explosion.

Our independent studies conclude that seismic measurements in the high-frequency region are feasible. However, major questions and uncertainties remain concerning how well high-frequency seismit energy propagates over the range of geologic structures that one might encounter. Current studies at Sandia are directed to answering questions related to the entire high-frequency seismic monitoring concept.

Senator BINGAMAN. In your view, would a number of challenge on-site inspections be needed in addition to internal seismic stations/arrays to adequately verify Soviet compliance with a one-kiloton threshold test ban?

Dr. KERR. Challenge on-site inspections, we suspect, would serve more as a deterrent than as a new powerful verification tool. In the event that telltale evidence exists, it is unlikely that the Soviets would honor a challenge. On-site inspections, limited in duration and scope as they were discussed during the CTB talks of late 1970's, would be of marginal worth in the technical sense but would increase in value if the time allowed were unlimited, the area to be observed were unrestricted, the instrumentation and equipment permitted were extensive, and requests for inspections were difficult, if not impossible, to deny; on-site inspections are a necessary but not sufficient condition.

Dr. BATZEL. There will always be a number of seismic events detected below some magnitude which will be impossible to identify. Therefore, there will always be the need to learn more about specific events. On-site inspections serve to deter the carrying out of clandestine explosions by increasing the economic cost and reducing the

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technical gain from such tests over that which was possible without on-site inspections, and by raising the political costs of refusing an on-site inspection request to avoid being proven to have been in noncompliance. An on-site inspection can also serve to prove that an unidentified event was in fact an earthquake. These roles for on-site inspections would be as valid for a 1 kt threshold as for a CTBT. It is important to note that on-site inspections are not foolproof. They are not likely to give "false positives" in the sense of indicating falsely that violations have taken place, but they may well give "false negatives" in the sense of failing to confirm explosions that are otherwise known to have occurred.

Dr. DACEY. There will always be a residue of events detected by seismic networks that cannot be identified as being explosive or natural in origin. The deterrence against cheating of on-site inspections and their potential to confirm that an event was natural rather than, say, a decoupled explosion, would be beneficial.

Senator BINGAMAN. If we could reach agreements with the Soviets on the internal seismic network and the challenge on-site inspections necessary for high confidence in verification of such a low threshold test ban, would you personally favor such a ban or would you still think such a treaty was not in our interest? Please briefly explain your answer.

Dr. KERR. From the technical point of view as a Laboratory Director, who annually is required to sign a document certifying the performance of many of the nuclear weapons in our stockpile, I have difficulty foreseeing conditions coming into existence that would allow me to support such a threshold. My judgement reflects the accumulated experience of the weapons Laboratories during and since the 1958–1961 moratorium.

The question stipulates that the limit will be enforced on both sides; however, the other side may well be able to find a way to perform critical tests at yields that might be necessary to solve their most critical weapons problems. This would lead to an asymmetry between the two major nuclear powers in the confidence reposed in their basic defense systems.

Dr. BATZEL. I would not favor such a ban. As long as our national security interests depend on the deterrence of war with nuclear forces, a low threshold test ban (LTTB) is not in our national interest. For the last 15 years, the Soviets have undertaken an extensive modernization program while our nuclear deterrent force has aged. Our forces are in need of modernization for improvements in safety, security, survivability, and effectiveness. An LTTB would prevent these needed improvements and severely impact the development of new weapon systems vital to our national security. [Deleted.]

I believe that such a test ban should be considered in the total context of U.S. arms control objectives. For example, our START proposal allows for the modernization needed to achieve a more survivable deterrent, while at the same time calling for substantial force reductions. It would be most unwise to enter into a LTTBT or a CTBT until we see what can be accomplished in the Geneva Negotiations. These negotiations could produce agreements that would lead to a much more stable world. Once we have a stable world, an LTTBT or a CTBT will be more easily achieved.

Dr. DACEY. Given the problems that have risen regarding the verification at the 150 kiloton threshold, we believe that a one kiloton threshold would present great difficulties. Estimates for yields that small, given the feasibility of partial or complete decoupling, would be highly uncertain unless very intrusive on site monitoring activities were permitted.

Beyond the question of verification, we believe that limitations on our research and development, which are the nature of test bans, are bad arms control. We believe that our arms control efforts should be focused on limiting the deployment of destabilizing weapons.

FACILITIES CONSTRUCTION

Senator BINGAMAN. Dr. Dacey mentioned the problem of the adequacy of the facilities at the DOE labs and the long leadtimes in getting approval for such facilities, compared to private industry. Could each of you tell us what is your highest priority facility which did not get included in the budget submitted to Congress? How much funding is needed for this facility in FY 1986? Please provide a justification for the project.

Dr. BATZEL. The highest priority project requested for FY 1986 and not included in the President's budget is the Weapons Technology Complex. This facility upgrades an existing structure to modern earthquake standards and also provides additional office space to consolidate and upgrade the work areas for weapons program scientists. The main building, which houses most of our weapons program, happens

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to be the building on the Livermore site which presents the greatest hazard in a very large earthquake. Upgrade of this building to modern seismic standards has been planned for a long time, but not yet funded. The total project cost is $20.7 million, including the construction of additional office space for weapons program work. The seismic upgrade portion of the project will cost about $7.2 million. First year (FY 1986) funding should be about $2 million with remaining funding in FY 1987.

Since our last budget submission for this project, we have been placed under more stringent rules limiting our flexibility in meeting our facility/housing requirements. Previous practice at the laboratories for using operating funds to supply temporary personnel housing facilities are now being disallowed by DOE. This makes the Weapons Technology Complex all the more urgent. The need to properly support our weapons program scientists is becoming critical as we undertake more complex and sophisticated advanced nuclear weapons concepts.

Dr. KERR. We were disappointed that the President's budget for FY 1986 did not include any new facilities construction starts for the weapons research and development program at Los Alamos National Laboratory. This is a major problem coming as it does in the wake of very limited FY 1985 construction funding. Especially alarming, because of the degree to which near-term programmatic progress will be impeded, is the omission of funds for the Laboratory Data Communications Center.

The use of high speed computers and mathematical models to simulate complex physical processes has been and continues to be the cornerstone of the national security programs at Los Alamos National Laboratory. This broad ability to do computer modeling is a key factor in the international status of the laboratory as a leading applied science institution. State-of-the-art computing and data communications are essential for maintaining that leadership and in meeting our national security program goals and commitments.

We are now approaching a crisis because our physical plant capacity to support computing and data communications equipment has been over-extended. The Laboratory Data Communications Center is required to provide support for the new generations of supercomputers that the laboratory must acquire in the years just ahead, to house the data communications equipment that will be needed to provide the staff with access to those computers, and to centralize part of our telecommunications equipment in a secure area.

Our long-range plans have been structured to provide for growth in computer and data communications capability in phase with our program requirements. At present 85 percent of our computing resources are used for defense-related activities. These activities are now expanding because of major new advanced weapons design programs and a very rapid growth in strategic defense technology research which will require significantly increased computing capability. We are also proceeding with new collaborations with other laboratories, universities, state and federal offices, and industries along the Rio Grande Research Corridor—collaborations in which communications will play a major role as our data network becomes linked with the New Mexico Technet.

The existing Central Computing Facility will soon have neither the space nor the supporting services, such as electric power and cooling, for computing the data communications equipment that is planned to support our program needs. The Laboratory Data Communications Center is urgently needed. First year funding, at $3 million, should be restored in the FY 1986 budget. The total estimated cost for this project is $25 million.

Dr. DACEY. Sandia's most critical facility need not included in the President's FY 1986 budget submittal is our proposed Instrumentation Systems Laboratory. Nearly half of the facility, which is sponsored by DOE's Office of Military Application (OMA), will be used for Verification and Control Technology activities. The building will gather instrumentation, telemetry, and associated test activities for OMA and Office of International Security Affairs together in a single facility, allowing maximum technical synergy and minimum test facility redundancy. We clearly see the verification technology evolving to increasing reliance on microprocessor-based computers, highly integrated microelectronic logic, and very specialized sensors. Development, assembly, and testing of systems with these components simply cannot be done reliably and effectively in mobile offices and work spaces which are inadequate for these new technologies. Predictable performance at the state-of-the-art in instrumentation will be a fundamental requirement of competent verification systems and we believe that the Instrumentation Systems Laboratory is essential to that end. Needed FY 1986 funding for the facility is $6.2 million. A description of the facility is provided for the record. A more detailed justification is contained in a classified document entitled, "Instrumentation Systems Laboratory," RS 5000/85/008, dated February 20, 1985, available upon request.

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INSTRUMENTATION SYSTEMS LABORATORY

SANDIA NATIONAL LABORATORIES, ALBUQUERQUE, NM

Supports evolving high technology instrumentation systems development of national urgency:

I. Validation of nuclear-weapon stockpile integrity, reliability and use control features.

II. Verification and control instrumentation for nuclear weapon treaty monitoring and burst reporting.

III. Simulators to insure nuclear weapon compatibility with computer-based avionics of new aircraft, e.g., B1-B.

Gross Space (square feet)	140,000
Net Space (square feet)	81,000
Offices (square feet)	40,000
Laboratories (square feet)	41,000
Occupancy (people)	345
Total estimated cost (dollars)	20,000,000

Proposed Schedule: Authorization—FY 1986; Occupancy—FY 1989.
Sponsor: U.S. Department of Energy, Office of Military Application.

INSTRUMENTATION SYSTEMS LABORATORY

I. Nuclear Weapon Reliability and Control

Modern nuclear weapons contain sophisticated electronics for operation, safety, and use-control.

Special telemetry instrumentation is flown on selected weapons (Joint Test Assemblies) to monitor and verify reliability of these complex systems to assure that there are no subtle undiscovered problems in the nuclear stockpile, and to verify that the protective devices are operational but do not interfere with performance. All development test flights must also fly with special evaluation instrumentation.

The complexity of future weapon systems now entering development, coupled with recent experience, requires microprocessor-based software-controlled instrumentation to assure that all problems are identified and rectified during development. Correction of problems during production and especially after stockpile deployment is very expensive and disruptive.

II. Verification and Control Instrumentation

Sandia is the national center for development of satellite instrumentation, both for Limited Test Ban Treaty monitoring of clandestine nuclear bursts in peacetime [deleted].

Expanded test facilities are required to support qualification of space instruments which will be deployed in the future by *manned* (shuttle) spacecraft. [Deleted.]

Ground-based satellite-linked instrumentation systems must be developed, both for supporting future nuclear-weapon treaty negotiations, e.g., comprehensive test ban treaties and for monitoring resulting treaty compliance. [Deleted.]

III. Nuclear Weapon Carrier Compatibility

New aircraft have multiple microprocessor-based avionics which interface with the pilot through video displays. Sandia must insure that all weapons will function properly with this combined hardware/software communication/control network.

Growing number of aircraft (United States and North Atlantic Treaty Organization), increasingly complex weapons, and expanding combinations of missions demand development of computer-based simulators with broad diagnostic capabilities.

All these new instrumentation tasks share the following technologies:

High reliability, very-large-scale integrated circuitry which requires computer-assisted design, analysis, and layout.

Precision electromechanical scanners/trackers/sensors.

Special purpose electronic and environmental test facilities.

Large scale high density memory chips and ultra-fast data transmission rates.

Special laboratories are required for:

Microelectronic assemblies: static-free, clean rooms

Test and computer-aided design equipment: temperature and humidity controlled environments.

Space simulation: large temperature-cycled vacuum chambers.

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Approximately half of the 345 people working in these activities presently occupy mobile offices, temporary buildings, and World War II Butler-type buildings. Attempting to conduct microelectronics development and assembly in such facilities which lack even basic laboratory capabilities results in device failures, rework, reduced reliability, and expensive equipment downtime.

SUMMARY

Urgent national needs for increasingly complex instrumentation for validation of stockpile integrity and reliability, monitoring of nuclear bursts [deleted] and assuring modern aircraft and weapon compatibility require a major new facility on the shortest possible time scales.

Senator BINGAMAN. Gentlemen, we appreciate your testimony very much.

Thank you all.

[Whereupon, at 5:11 p.m., the subcommittee adjourned, to reconvene upon the call of the Chair.]

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